ESTONIAN UNIVERSITY OF LIFE SCIENCES
Institute of Veterinary Medicine and Animal Sciences

Janette Peltonen

ASSOCIATIONS BETWEEN PUPPY AND ADOLESCENT DIET AND CONJUNCTIVITIS IN DOGS

KUTSIKATE JA NOORTE KOERTE TOITMISE SEOS KONJUNKTIVIIDI ESINEMISEGA KOERTEL

Final thesis
Curriculum in Veterinary Medicine

Supervisors: Anna Hielm-Björkman, DVM, PhD
Professor Toomas Orro

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Estonian University of Life Sciences
Kreutzwaldi 1, Tartu 51014

Abstract of Final Thesis

Author: Janette Peltonen

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The conjunctiva is a part of the external eye and its inflammation is called conjunctivitis. Certain nutrients are important for eye health. The aim of this study was to associate the food item data from the dog's puppyhood and adolescence with the diagnosis of conjunctivitis at adult age and see if any positive or negative associations could be found. Hypothesis was that the more fats the dog eats, the less there would be conjunctivitis.

Puppy and adolescent diet data used as study material were from DogRisk questionnaire collected from Finnish dogs December 2009 until April 2015. Statistical analyses were done with IBM SPSS software and a p-value ≤0.05 was counted as significant. Conjunctivitis and eye inflammation were put as one variable, and together was a common diagnosis in study populations (58.3% puppies, 58% adolescent).

There was seen negative association with conjunctivitis when puppies were often fed with cooked vegetables (p = 0.009; OR = 0.911; 95% CI = 0.850–0.977) or animal fat (p = 0.047; OR = 0.870; 95% CI = 0.759–0.998) and adolescent fed with raw bones and cartilage (p = 0.011; OR = 0.933; 95% CI = 0.885–0.984) or human meal leftovers (p = 0.021; OR = 0.927; 95% CI = 0.870–0.989). The associations were significant between those food items and conjunctivitis, but the high odds ratio indicates that the association is not very strong and do not support causality. These associations should be further tested and confirmed in diet intervention studies.

Keywords: Eye inflammation, feeding, dogs

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Silma sidekest on osa välisest silmast ja selle põletikku nimetatakse konjunktiviidiks. Teatud toitained on silmade tervise seisukohalt olulised. Selle uuringu eesmärk oli uurida seoseid koera kutsika ja noorukieas saadud toidu andmed konjunktiviidi diagnoosiga täiskasvanueas. Uuringu hüpotees oli, et mida rohkem rasvarikast toitu koer nooruses sööb, seda vähem esineb konjunktiviiti täiskasvanud eas.

Uuringumaterjalina kasutati kutsikate ja noorte koerte toitmise andmed mis pärinesid küsimustikust DogRisk. Vastav küsitlus viidi lobi Soomes alates detsembrist 2009 kuni aprillini 2015. Andmed analüüsiti statistilise tarkvaraga IBM SPSS ja p-väärtus ≤0,05 loeti oluliseks. Küsimustiku andmetes liideti omavahel konjunktiviidi ja silmapõletiku diagnoosid ja kasutati seda kui uuringu väljundit. Konjunktiviiti täiskasvanud eas esines kutsikate andmestikus 58,3% ja noorte koerte andmestikus 58,0%.

Negatiivset seost konjunktiviidi esinemisega täiskasvanueas täheldati siis, kui kutsikaid toideti sageli keedetud köögiviljadega (p = 0,009; OR = 0,911; 95% CI = 0,850–0,977) või loomarasvaga (p = 0,047; OR = 0,870; 95% CI = 0,759–0,998) ja noori koeri toideti toorete luude ja kõhrega (p = 0,011; OR = 0,933; 95% CI = 0,885–0,984) või inimtoidu jääkidega (p = 0,021; OR = 0,927; 95% CI = 0,870–0,989). Negatiivsed seosed olid nende toiduainete ja konjunktiviidi vahel olulised, kuid kõrged tõenäosuse suhted (OR) viitavad, et seosed ei ole väga tugevad. Leitud seoseid tuleks täiendavalt testida ja kinnitada söötmiskatsetes.

Märksõnad: Silmapõletik, toit, koerad

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LIST OF ABBREVATIONS

CI	Confidence interval
DHA	Docosahexaenoic acid
EPA	Eicosapentaenoic acid
KCS	Keratoconjunctivitis sicca
OR	Odds ratio
PCR	Polymerase chain reaction

INTRODUCTION

The conjunctiva is a mucous membrane which covers the anterior part of the eye globe till the limbus and the inside linings of the eyelids and around the third eyelid. An inflammation of the conjunctiva is called conjunctivitis (Maggs, 2013a). Conjunctivitis is a very common ocular disease seen in clinical practice and it can be primary, or secondary to other systemic or ocular diseases. It can be caused by bacteria, viruses, allergy, and irritants (Gould and McLellan, 2014). Trauma can be a cause as well where especially eyes of hunting dogs are exposed to bushes and branches (Houlton, 2015). Genetics can also be a cause as certain breeds are exposed to ulcers or irritation of conjunctiva because of the conformation of eyelids or length of the muzzle (Maggs, 2013c; Gould and McLellan, 2014; Krecny *et al*., 2015). Conjunctivitis is less commonly reported as a noncutaneous sign of adverse food reaction (Mueller and Olivry, 2018). There is only a little knowledge of "allergies" affecting the eye, in dogs. Ocular signs can exist at the same time with canine atopic dermatitis which makes it important to evaluate and control clinical signs (Lourenço-Martins *et al*., 2011). Food hypersensitivity can cause pruritus and discomfort to the eyes and topical eye treatments might be needed if there is an involvement of the conjunctiva (Peña and Leiva, 2008).

A balanced diet with a proper amount of energy is needed for normal growth and health maintenance (Case *et al*., 2011). Most dogs are fed commercial kibble or canned pet foods (Parr and Remillard, 2014). Feeding alternatives for commercial dry foods are raw foods and home-prepared foods. Antioxidants like carotenoids and vitamin C are important for the eye health (Wang *et al*., 2016). Vitamin A is very important for vision. Dogs can make vitamin A from carotenoids found in plants, or they can get active vitamin A by eating animal products like fish liver oils, egg yolk or liver (Case *et al*., 2011). Vitamin C can be synthesized from glucose. Omega-3 fatty acids are shown to enhance eye health (Delaney and Fascetti, 2011).

There were two diet data materials (puppy and adolescent) in this study coming out from the Finnish DogRisk questionnaire, which was gathered online from December 2009 to April 2015, including the data on what 6659 dogs had been fed when they were puppies and on

what 5564 dogs had been fed when they were adolescent dogs. The data was analyzed with IBM SPSS statistics. The data consisted of owner reported information, meaning that owners had filled in background information of the dog, information of living conditions, diseases the dog and its mother had suffered from, and about their feeding at different time periods of its life: as puppies (2-6 months of age), as adolescent (6-18 months of age), and as adults. Owners were asked to select diagnoses that the dogs had in their medical records, from a given list of diagnoses. Depending on the veterinarian they might write the diagnosis in Latin or only as “eye inflammation”, in the paper that will go home with the owner. Therefore, there were both eye inflammation and conjunctivitis to choose from in the questionnaire and we think eye inflammation here usually means the same as conjunctivitis.

The hypothesis of this work was that if dogs often fats it may cause less eye disease. It is known that food hypersensitivity can be one cause of conjunctivitis. Nutrition plays a big role in having healthy eyes and good vision. When a dog has access to a balanced diet where all required elements are given, including essential nutrients, it should be healthy.

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1. LITERATURE REVIEW

1.1. External eye and conjunctiva

1.1.1. External eye

The eye is the organ of vision. The external structures of the eye that can be seen are pupil, iris, limbus, conjunctiva and third eyelid (Figure 1). Superior and inferior punctum are also visible in the eyelids as well as medial and lateral canthus (Miller, 2013).

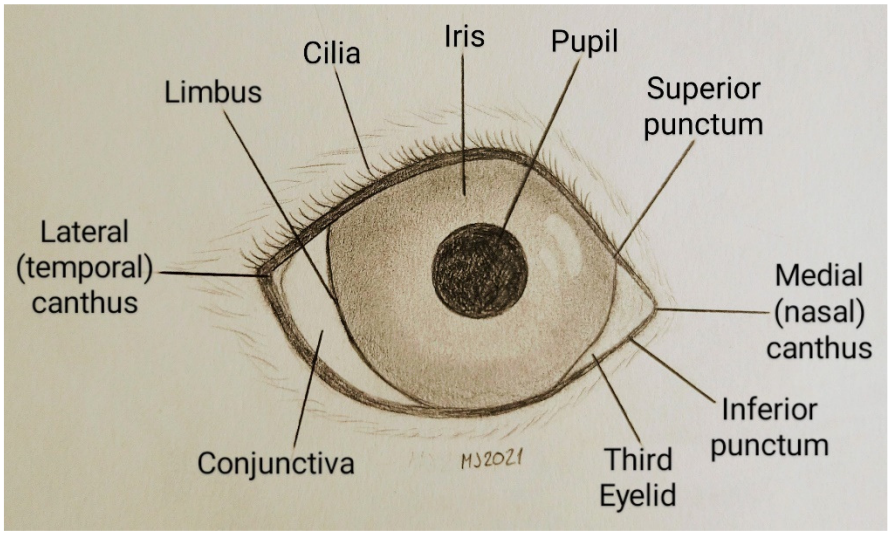

Figure 1. Parts of the external eye by Mirelle Juutilainen.

1.1.2. Conjunctiva

The conjunctiva is a mucous membrane which covers the anterior part of the globe adjacent to the limbus, the outer and inner surfaces of the third eyelid and the inner surface of the lids. The inner surface of the lids is tightly bound to the palpebral conjunctiva (Figure 2). The bulbar conjunctiva is attached loosely over the globe to the episclera and more firmly anchored near the limbus (Maggs, 2013a). Its loose connection makes it possible for the globe

to move beneath the eyelids. The space lined by the conjunctiva between the eyelids and globe is called conjunctival sac (Gould and McLellan, 2014).

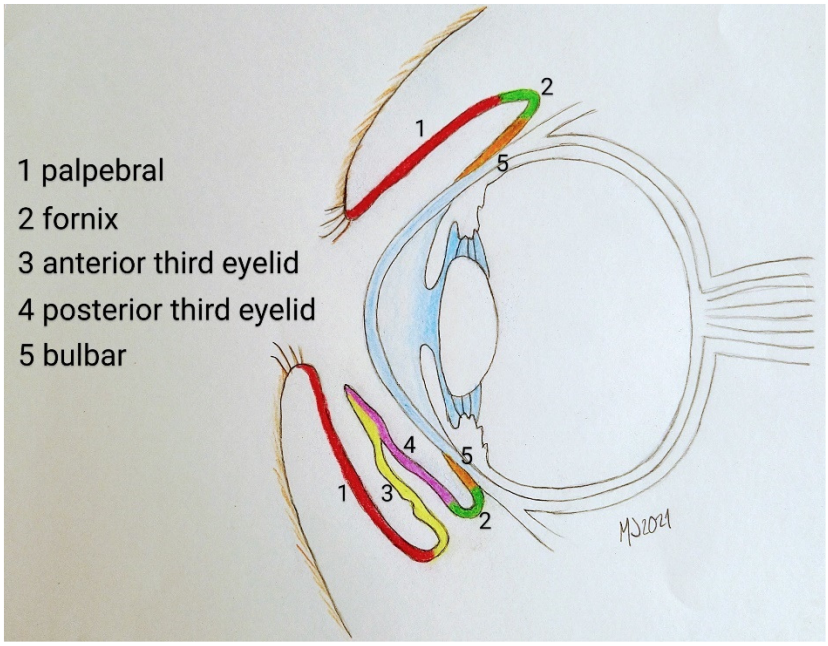

Figure 2. Parts of the conjunctiva. Adapted from Maggs (2013a) by Mirelle Juutilainen.

The conjunctiva is composed of a nonkeratinized columnar epithelium including goblet cells, the substantia propria is subtending it and tear film is laid over it. The tear film nourishes and coats the conjunctiva as well as the cornea. Changes in tear film quality or quantity causes remarkable worsening in conjunctival and corneal health. The goblet cells in the conjunctiva contribute to the tear film mucin layer, which goes as a mucous thread in the conjunctival fornices. The mucous thread moves medially collecting cells and dust particles which will be disposed via the nasolacrimal duct or onto the skin in the medial canthus. The conjunctiva has good defense mechanisms. Antigens stimulate lymphocytes found on the subepithelial substantia propria and which will form active follicles. Those follicles can be found around the conjunctiva but are especially numerous on the bulbar surface of the third eyelid (Maggs, 2013a).

1.2. Conjunctivitis

1.2.1. What is conjunctivitis

Conjunctivitis is an inflammation of the conjunctiva. Classification of conjunctivitis is done based on duration, appearance, nature of discharge, and etiology which is also the most important. Conjunctivitis can be primary or secondary. More often it is secondarily inflamed with other ocular and periocular diseases, like keratitis, blepharitis, KCS, orbital disease, glaucoma, dacryocystitis, and uveitis (Maggs, 2013a). Conjunctivitis should also be differentiated from systemic diseases. It can also be infectious and caused by bacteria or viruses for example, or non-infectious caused by other factors like irritants, allergy or breed genetics (Gould and McLellan, 2014).

Ocular discharge, conjunctival hyperemia and chemosis (edema of conjunctiva) are characteristic for conjunctival inflammation (Maggs, 2013a). Ocular discharge can be mucoid, mucopurulent, purulent or haemorrhagic. Blepharospasm is one of the clinical signs. Ocular pruritus may be associated with some forms of conjunctivitis, especially with allergic conjunctivitis (Gould and McLellan, 2014).

1.2.1. Infectious conjunctivitis

Bacterial conjunctivitis usually occurs secondary to a trauma or an underlying disorder, like keratoconjunctivitis sicca (KCS), which leads to an opportunistic infection. Predisposing factors like KCS and entropion should be treated to avoid recurrence of conjunctivitis. Most common cultured bacteria are *Staphylococcus* and *Streptococcus* spp. and not so commonly Bacillus spp., Proteus spp., Escherichia coli. and Pseudomonas spp. (Gould and McLellan, 2014).

In dogs it is uncommon to have a primary infectious conjunctivitis, but it has been reported with canine herpesvirus-1, canine adenovirus-2 and canine distemper virus. Neonatal conjunctivitis in puppies might be seen after opening of eyelids and it is most likely caused by

canine herpesvirus-1 infection the puppies get from dam's genital tract (Gould and McLellan, 2014).

Mycotic conjunctivitis, keratomycosis, is uncommon but tends to be chronic. Crusts can form around the eyelid margins due to exudates. *Aspergillus* spp., *Candida* spp., and yeasts are the organisms most often involved. Usually there is a history of chronic conjunctivitis which has been treated with antibiotic or antibiotic-steroid therapy with no response (Maggs, 2013a). Parasites that can cause conjunctivitis in dogs are *Thelazia* spp. and *Leishmania* spp. The conjunctiva is one of the involved sites that *Leishmania* might affect (Maggs, 2013a).

1.2.2. Non-infectious conjunctivitis

Non-infectious conjunctivitis can be caused by irritants or allergy or it can be immune-mediated. Grit, smoke, dust, or many commonly used topical medications like tetracycline can cause conjunctivitis. Flushing of sand or dust out of conjunctival fornices with saline might reduce irritation (Gould and McLellan, 2014).

In immune-mediated conjunctivitis the conjunctiva has an exposed position and it contains lymphoid tissue which may initiate immunopathologic reactions and cause conjunctivitis. There are four immunopathologic conditions seen: allergic conjunctivitis, eosinophilic keratoconjunctivitis, nodular granulomatous episcleritis, and pannus (chronic superficial keratoconjunctivitis). These conditions mainly have signs of keratitis rather than conjunctivitis, excluding allergic conjunctivitis (Maggs, 2013a). KCS is mostly immune-mediated (Dodi, 2015).

Allergic conjunctivitis can be associated with hypersensitivity reactions. This can be seen in atopic dermatitis and mostly it is bilateral. Some animals have clinical signs depending on the current season of the year, while elimination diet can help others (Gould and McLellan, 2014).

1.2.3. Environmental factors

Genetics can predispose to conjunctivitis, and many traits in dogs can be inheritable. Inherited diseases can be related or unrelated to breed standards. Some conditions can be due to the use of the dog, as Greyhounds are injured when raising, or to their behaviour, as spaniels searching behaviour elevates the risk to get grass seed foreign bodies into their eyes (Gough *et al*., 2018). Hunting dogs, which work in vegetation like maize crop fields, are exposed to abrasion injuries around the eyes. Puncture wounds are also possible, and it can lead to enucleation of the eye (Houlton, 2015).

Poor conformation and malfunction of the eyelids is often causing pain, and the potential result can be blinding secondary to ocular disease, where especially the conjunctiva and the cornea are affected (Maggs, 2013c). Dolicocephalic dog breeds have a relatively enophthalmic conformation and the conjunctival fornices are deep, which may cause accumulation of mucus at the canthi and the disease it causes is known as 'medial canthal pocket syndrome' (Gould and McLellan, 2014). Brachycephalic dogs, for example Pugs and English Bulldogs, can have unusually prominent skin folds over the nose, shallow orbits, and prominent globes. This may cause the hair of nasal folds to contact the cornea causing epiphora, corneal vascularization, melanosis, or even ulceration (Maggs, 2013c). In a retrospective survey of ocular abnormalities in Pugs, Krecny *et al*. (2015) found out that 56 Pugs out of 130 had conjunctivitis.

Disorders of the cilia can cause corneoconjunctival irritation. Distichiasis, where cilia emerge from the meibomian gland openings, is especially seen in Golden Retrievers, Poodles and Cocker Spaniels. It can also be insignificant if there is no irritation of the eye. Some breeds like English Bulldog, may have stiffer shorter distichia which irritates the cornea. Cilia disorders produce epiphora, conjunctival hyperemia, corneal ulceration and blepharospasm (Maggs, 2013c).

Entropion, the eyelid margin rolling inward, is most frequently conformational in dogs and it usually affects both eyes. The lower eyelid is more commonly affected. Upper eyelid entropion is also possible especially in breeds with heavy upper eyelids, like Basset Hounds, Bloodhounds, Chow Chows and Shar-peis. In brachycephalic dogs, entropion is mostly seen in the medial lower eyelid and medial canthus as in broad-skulled dogs it is usually seen on

the lateral canthus and at the lateral part of the lower eyelid. It is believed that conformational entropion is inherited in many dog breeds, like Saint Bernard, Chow Chow, Irish setter, English bulldog, Golden and Labrador retrievers, Shar-pei, Chesapeake Bay retriever, and Great Dane. Clinical signs of entropion are epiphora or mucoid discharge, conjunctival hyperemia, corneal ulceration, blepharospasm, and damage to the eyelid's dermal surface due to tears. Also, corneal vascularization and melanosis are possible in chronic cases. It is uncommon to see rubbing of the affected area (Maggs, 2013c). Nictitating membrane's cartilage can evert in large-breed dogs and cause chronic conjunctivitis (Gough *et al*., 2018).

Ectropion, which means eversion of the eyelid, is mostly seen in the lower eyelid. Conformational or breed-related ectropion is the most common, which includes dog breeds with loose facial skin, like Saint Bernards, retrievers, Cocker Spaniels, and Bloodhounds. In these breeds ectropion is sometimes thought to be normal because it is so common. When ectropion causes conjunctivitis, keratitis, chronic epiphora, or worsens KCS, it needs surgical correction (Maggs, 2013c).

Living environment can have an impact on eye health. Dogs living in urban environment have more allergic symptoms than dogs living in rural environment. An association between less allergy and regular contact with farm animals is seen in dogs, which are living in outdoor conditions. Dogs were less allergic when they had contact with other animals regularly up to 6 months of age after moving away from their mother, while those dogs were more allergic which were growing up at this same time period, in cities (Hakanen *et al*., 2018).

Food hypersensitivity can have an influence on evolving conjunctivitis. It has been referred to by different names like food allergy, adverse food reaction and food intolerance. Some have true immunologic basis and are qualified as true hypersensitivity, and others like food intolerance might not be immunologically mediated. Adverse food reaction causes pruritic skin disorder and most likely immune-mediated mechanisms are type I, III and IV hypersensitivity reactions. In the intestine, passage of most macromolecules is blocked by epithelial and mucous cells. There may be increased risk of intolerance, if the gut's barrier function is compromised, and the damaged intestinal tract allows food allergens to penetrate causing the gut phagocytic system to become overloaded (Miller *et al*., 2013). Allergen detection and elimination are included in the treatment. Before finding the causing allergens, eye topical treatments are often needed to ease pruritus and discomfort. The topical treatment

depends on involvement of conjunctiva, ocular discharge, and secondary bacterial infection (Peña and Leiva, 2008).

1.2.4. Diagnostics

An eye with conjunctival inflammation should go through diagnostic testing including pupil size comparison, assessment of intraocular pressure and aqueous flare, Schirmer tear testing and fluorescein staining (Maggs, 2013a).

Pupil size comparison includes evaluation of the size, symmetry and shape of the pupil in both bright and dim light. This evaluation is done by retroillumination where the examiner is standing at arm's length from the patient holding the light source close to examiner's eye and directing it over the patient's nose bridge to equally illuminate both pupils (Maggs, 2013b).

Intraocular pressure and aqueous flare should be assessed. Intraocular pressure can be measured with tonometry. Normal intraocular pressure in canines is approximately 10 to 20 mm Hg. Pressure of the animal's both eyes should be measured and compared. The pressure between left and right eye should not vary more than 20%. Intraocular pressure is increased in glaucoma, decreased in anterior uveitis and unaffected in conjunctivitis, scleritis and keratitis. Aqueous flare is called when there is breakdown of the blood-ocular barrier and plasma proteins leak into the aqueous humor found in the anterior chamber. Anterior uveitis is diagnosed if flare is seen. Magnification and a focal intense light source are used in a totally dark room to dilate the pupil (Maggs, 2013b).

The Schirmer tear test measures the precorneal tear film's aqueous portion production. This should be done if clinical signs suggest KCS, or if there is mucoid discharge from the eye, a lackluster corneal surface or melanosis and in case of superficial corneal blood vessels. The test should be performed before using topical solutions to avoid false elevation of the Schirmer tear test value. Mydriatic topical anesthetics and parasympatholytic drugs reduce the test value. The strip is inside a sterile wrapper. The strip is folded inside the wrapper, which is opened, and the strip is put over the middle to lateral third of the lower eyelid and kept there for 60 seconds. The moistened part of the paper is immediately measured after

removal from the eye. A normal dog's readings should exceed 15 mm in 1 minute and if it is under 10 mm in 1 minute it can be considered to have KCS (Maggs, 2013b).

Fluorescein staining is done to identify if there is a corneal ulcer. Fluorescein is a dye that is water-soluble and retains in hydrophilic structures. The dye is retained in the hydrophilic stroma when hydrophobic epithelium is ulcerated. A strip is taken out from a packet and moistened with sterile saline, and then you touch the eye with it. Excess dye is rinsed with sterile saline and the eye should be examined with magnification and a light. Corneal epithelial defects are seen as bright green areas. In deep ulcers where the Descemet's membrane is exposed, the ulcer is not stained (Maggs, 2013b).

Prognosis for conjunctivitis and corneal ulcer therapies may improve when a dry eye is detected and treated at an early-stage, thereby disease progression risk reduces (Wynne, 2020). A specific etiologic diagnosis should be found when primary conjunctivitis is verified after diagnostic testing. Etiologic testing can include bacterial culturing, conjunctival scrapings and conjunctival biopsy (Maggs, 2013a).

Very seldom bacteria is the primary cause of conjunctivitis. Bacterial culturing is usually done if an antibiotic treatment was unsuccessful. The more common reason for the failure of treatment, is not to determinate the etiologic factors behind the conjunctivitis. A culture sample is taken with moistened swab and the sample is plated as soon as possible onto a blood agar or into a thioglycolate and nutrient broth (Maggs, 2013a). Large number of bacterial taxa like Gram- negative aerobes, which are capable of causing inflammation, might not grow on culture but can be detected by analyzing microbial DNA via next-generation sequencing methods. This means DNA extraction and sequencing it with polymerase chain reaction (PCR) (Banks *et al*., 2020).

Conjunctival scrapings are mostly used for defining the cause of conjunctivitis by staining the scraping for bacteria or cells. Identifying cells from conjunctival masses helps determining the malignancy. Conjunctival biopsy is a small "snip biopsy" which can usually be taken in topical anesthesia. When ophthalmic anesthesia starts to work, is topical ophthalmic anesthetic gently applied to the conjunctival surface with a cotton-tipped applicator. Then a small "tent" of conjunctiva is raised with fine tissue forceps and resected (Maggs, 2013a).

1.2.5. Treatment

Determining and treating the causative factors behind the conjunctivitis should be done first. It means correction of eyelids, treatment of deficient tear film or removal or foreign bodies. Then appropriate therapeutic agents are chosen which include antibiotics, corticosteroids, cleansing agents, vasoactive agents and topical mast cell stabilizers and antihistamines (Maggs, 2013a). Nutraceutical diet containing anti-inflammatory and antioxidant ingredients together with pharmacological treatment can improve the clinical signs of dogs suffering from KCS compared to dogs that are treated with pharmacologically and are given standard diet (Destefanis *et al*., 2016).

Topical antibiotics are appropriate when treating primary bacterial conjunctivitis or when overgrowth of normal conjunctival flora needs to be limited, while at the same time treating a primary cause of conjunctivitis such as KCS. Corticosteroids are often used in conjunction with antibiotics. These can be used after the primary cause has been treated and in non-infectious disorders, when there are immune-mediated causes like allergic conjunctivitis or pannus. Cleansing of the eye from accumulated ocular discharge will improve penetration of ophthalmic medications and make the patient more comfortable. It also prevents blepharitis, adhesions to conjunctiva or eyelid, periocular dermatitis, and maceration. Vasoactive agents are used topically in low concentration to get vasoactive effects in acute conjunctivitis or allergy, but better and more potent are topical corticosteroids (Maggs, 2013a).

Topical mast cell stabilizing agents like olopatadine, sodium cromoglycate and lodoxamide are used in treating allergic and eosinophilic conjunctivitis. These should be used only after elimination of other causes of conjunctivitis. There is a lack of information about the efficacy and safety in animals (Maggs, 2013a). In humans mast cell stabilizers can also be used together with topical antihistamines (Castillo *et al*., 2015). Treatment for parasitic conjunctivitis is to remove or flush out the nematodes and give ivermectin and moxidectin (Gould and McLellan, 2014).

1.3. Feeding of dogs

1.3.1. A balanced diet

A balanced diet is needed for normal growth and maintaining health when dogs mature. The diet consists of nutrients which contribute to tissue maintenance, growth, and optimal health. Essential nutrients must be given in the diet because the body cannot synthesize those. The body can synthesize nonessential nutrients through de novo synthesis and/or obtain them from the diet. There is requirement for energy, and for six nutrient categories which are water, proteins, carbohydrates, fats, vitamins, and minerals. The body needs energy for normal growth, reproductive performance, physical work, and maintenance. The dog's use for energy takes up 50 to 80% of the diets dry matter. Water is the most important nutrient that the animal needs and already a loss of 10% of body water results in death (Case *et al*., 2011).

1.3.2. Carbohydrates

Carbohydrates make up 60% to 90% of plants dry-matter weight. They can be classified as monosaccharides, disaccharides and polysaccharides. Monosaccharides are simple sugars, and glucose, galactose and fructose are metabolically the most important ones. Glucose is circulating in the bloodstream and it is the primary carbohydrate that is used for energy by the body's cells. It is found in sweet fruits like in grapes and berries, and it is an end product of starch digestion and hydrolysis of glycogen. Polysaccharides consist of many linked monosaccharide units and include starch, glycogen, dietary fiber and dextrins. Starch is the most used carbohydrate source found in most commercial pet foods (Case *et al*., 2011).

Dietary fiber consists of multiple forms of plant carbohydrate. Plant gums and mucilages, pectin, cellulose and hemicellulose, are the biggest components of dietary fiber. The only noncarbohydrate component of fiber is lignin. An optimal amount of fiber in the diet is needed for the gastrointestinal tract to be healthy and to function normally. Nonfermentable fiber is needed to increase the bulk of the diet, maintain normal gastrointestinal tract motility and intestinal transit time, and contribute to satiety. Fermentable fibers have effects on gastric emptying. Short-chain fatty acids, which are energy sources for mucosal cells of the

colon, are produced by fiber fermentation by the colonic bacteria. In pet foods, dietary fiber mostly comes from beet pulp, powdered cellulose and pea fiber. Hulls of soybean and peanut, as well as tomato, citrus and grape pomaces are also common sources (Case *et al*., 2011).

1.3.3. Fats

Lipids consist of compounds like dietary fat. Those compounds are classified by their insolubility in water and their solubility in organic solvents. One may categorize them into simple lipids, compound lipids and derived lipids. The most common form of fat in the diet and in waxes are the triglycerides. Triglycerides contain fatty acids and depending on the length of the fatty acid carbon chain, they may be saturated, monosaturated or polyunsaturated. Essential fatty acids are polyunsaturated. The body stores energy in the form of triglycerides. Carbohydrates are stored as glycogen and there is limited capacity to do so but storing the surplus energy in the form of fat is close to limitless (Case *et al*., 2011).

Fats are needed for absorption of fat-soluble vitamins and to provide essential fatty acids. Fatty acids are precursors for eicosanoids which are inflammatory mediators. Linoleic acid is an essential fatty acid. Linoleic acid and arachidonic acid are omega-6 fatty acids. Linoleic acid sources are fats of animals that are fed with plants containing much linoleic acid or vegetable oils. Animal fats are good sources for arachidonic acid (Delaney and Fascetti, 2011).

Long-chain fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are more beneficial, and sources to get it are fish oil, algal oil and krill oil (Delaney and Fascetti, 2011). Omega fatty acids have been shown to have good impact on eye health in humans. Marine food, like fish, contains omega fatty acids and especially long-chain omega-3 fatty acids, are good for eye health, including those having dry eye disease (Zhang *et al*., 2020). Retinal function in young dogs benefit from dietary DHA. Improvement of rod sensitivity was seen when puppies consumed the highest concentration of DHA, both in milk and in dry food (Heinemann *et al*., 2005).

1.3.4. Protein and amino acids

Proteins are the main structural components of body tissues and organs like collagen and elastin, actin and myosin in muscles, keratin in hair, nails and skin, as well as in hemoglobin, albumin, globulin and transferrin. Proteins also function as antibodies, enzymes and as hormones like insulin. Proteins are composed of amino acids. which further are composed of carbon, oxygen, hydrogen, nitrogen and sometimes phosphorus and sulfur. Nitrogen is synthesized to other nitrogen-containing compounds like pyrimidines, purines, nucleic acids, nucleotides, nitric oxide, creatinine and some neurotransmitters (Gross *et al*., 2010).

Proteins are needed in the diet to provide nitrogen and amino acids. Amino acids are divided into essential and nonessential amino acids. Essential amino acids for dogs include arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. These essential amino acids can come in isoforms as L-amino acids and D-amino acids. L-amino acids are a more common form and can better be used by the body than the D-amino acids. The exception is D-methionine which can fill up to 50% of the requirement of methionine and that is why the dog food can be supplemented with DL-methionine. Taurine deficiency can be a cause of dilated cardiomyopathy (Delaney and Fascetti, 2011).

Many pet foods have high-protein concentrations which comes from animal tissues from turkey, chicken, beef, lamb, fish and from viscera like lungs, spleens and livers. Grains also contain some protein, but a large portion of cereal-based dry foods use rice, wheat, corn and barley, that have low protein content. Concentrated sources of plant protein that are used in pet foods are corn gluten meal and soybean meal (Gross *et al*., 2010).

1.3.5. Vitamins

Vitamins are needed in small amounts in many of the body's metabolic processes functioning as enzyme precursors, as essential enzymes or as coenzymes. They are organic molecules, and most vitamins, except vitamin C and K, must be obtained from the diet because the body cannot synthesize them. Vitamins can be classified as fat-soluble vitamins which are A, D, E and K, and water-soluble vitamins including vitamin C and all B vitamins. Fat-soluble vitamins can be stored in the body and deficiencies of those develop slower (Case *et*

al., 2011). Vitamin K can be produced in adequate amounts by the gut flora (Delaney and Fascetti, 2011).

Vitamin A includes the related compounds retinal, retinol and retinoic acid. The biologically most active form is retinol. Vitamin A is involved in vision, reproduction, bone growth and epithelial tissue maintenance. The retina has rods where retinal is combined with the protein opsin forming rhodopsin which is also called visual purple. Rhodopsin is a light-sensitive pigment, and it enables the adaption of the eye when light intensity changes. When there is deficiency of vitamin A, there is less retinal for building rhodopsin which makes the rods very sensitive to changes of light leading eventually to night blindness. Dogs can convert carotenoids to an active vitamin and that is why they do not need an animal source in the diet to get vitamin A. Carotenoids can be found in plants, especially in carrots and sweet potato. Animal products like fish liver oils, egg yolk, milk and liver contain active vitamin A (Case *et al*., 2011).

Among water-soluble vitamins, B vitamins are the only essential ones. Dogs can synthesize vitamin C from glucose. Internal organs, yeasts and germinal portion of grains are sources for vitamin B. Animal sources are needed to get B12 (Delaney and Fascetti, 2011). Dogs given antioxidant supplements containing for example carotenoids and vitamin C had increased retinal function and decreased change of refractive error where the light is not focused accurately on the retina. It was also shown that the change of refractive error can be slowed down in dogs by giving antioxidant supplementation (Wang *et al*., 2016).

1.3.6. Minerals

Minerals are essential for metabolic processes in the body. Minerals are divided into macrominerals and microminerals. Most of the body's mineral content are macrominerals, which include calcium, phosphorus, sulfur, magnesium, iron and the electrolytes potassium, sodium and chloride. Microminerals are known as trace elements, meaning there is a very small amount of them in the body and they are needed in small quantities in the diet. Minerals have many functions in the body, like providing skeletal support, aiding in muscle contractions and nerve transmission, functioning in maintaining water and electrolyte balance as well as activating enzymatically catalyzed reactions (Case *et al*., 2011).

1.3.7. Heating of food

Satpute and Annapure (2013) say that many heat sensitive nutrients are found in food like minerals, vitamins and nutrients which have functional properties. They say that heat process causes maximum destruction of vitamins and minerals, and that vitamin loss is caused in processing and cooking conditions. Heating vitamin A, especially at higher temperatures and in the presence of oxygen, makes it lose its activity (Satpute and Annapure, 2013).

1.3.8. Feeding alternatives for dogs

Feeding alternatives for dogs can be processed, home-prepared or raw food. Commercial pet food products are divided into dry (kibbles and biscuits), wet (canned) and semimoist foods (sausages for dogs), according to the processing method, moisture content and preservation methods. Manufacturing dry pet food happens as follows; homogenous dough is made by mixing ingredients and then shaping and baking it. Then kibbles are extruded and dried and coated with fat or some other palatability enhancer. Dry foods often consist of poultry, meat or fish products, a variety of cereal grains, maybe some milk products, vitamin and mineral supplements, and vegetable fats or oils (Case *et al*., 2011).

Most owners regularly buy treats to dogs and they give them when rewarding their behavior, in training-sports activities, as pastime or if they want health benefits for their dogs. The most common treats given to dogs are biscuits, dental care sticks, tender treats, rawhides, and strips that are meat-based (Morelli *et al*., 2020).

Home-prepared food can include feeding of raw or cooked food. Delaney and Fascetti (2011) say that home-prepared diets can be used in dogs which have special nutritional concerns due to medical condition and when the commercial veterinary therapeutic diets are not able to help. They also say that home-prepared diet can help in managing adverse food reactions. One can choose a carbohydrate and protein source which are not available in commercial foods, and to avoid preservatives and additives. For dogs with multiple medical conditions, like renal disease, pancreatitis and hyperlipidemia, a suitable home-prepared diet can be planned (Delaney and Fascetti, 2011). Home-prepared diet can be beneficial when the recipe

is properly formulated and tested. An individual formulated diet can be modified to closely meet the dog's needs by altering nutrient levels (Case *et al*., 2011).

A raw meat-based diet constitutes of uncooked ingredients derived from wild or domesticated animals that are fed to dogs or cats. Ingredients include uncooked eggs and unpasteurized milk as well as internal organs, bones and skeletal muscles from mammals, poultry or fish. This diet can be home-prepared or commercial. The commercial form can be fresh, freeze-dried or frozen and their nutrients should be balanced and complete (Freeman *et al*., 2013).

Raw bones and cartilage contain many substances that are good for health. Dental calculus is effectively removed by raw bovine cortical bones the dogs chew (Marx *et al*., 2016). Bones contain calcium and phosphorus. Cartilage can be found for example in long bones as articular tissue in joints between two endochondral bones (Hall, 2015). Cartilage contains glucosamine found in articular cartilage, synovial fluid, and intervertebral disc (Henrotin *et al*., 2012). Cartilage and extracellular matrix contain chondroitin sulphate which has anti-inflammatory activity (Bishnoi *et al*., 2016). Glucosamine and chondroitin sulfate are used for dogs to treat osteoarthritis as add-on therapy. They can be given also alone if the dogs cannot tolerate NSAIDs (Bhathal *et al*., 2017).

Highly digestible feed with fresh meat and readily fermentable substrates can promote growth of more balanced bacterial communities. It can also promote a positive change of healthy gut functions (Sandri *et al*., 2017). Probiotic supplementations have successfully been used in companion animals to prevent allergy, to prevent and treat acute gastroenteritis and to treat IBD (Grześkowiak *et al*., 2015). People, that feed raw meat to their dogs, is said to be in increased risk of potential transmission of meat-borne pathogens (Fredriksson-Ahomaa *et al*., 2017). A large international survey proved the opposite that raw feeding seemed to protect also the human family from meat-borne pathogen derived illnesses (Anturaniemi *et al*., 2019).

2. AIMS OF THE STUDY

Data from the DogRisk interned based questionnaire has been gathered since 2009 from Finnish dog population.

The author was given data from the DogRisk questionnaire to look at associations between diet and conjunctivitis in the dog.

The aim was to curate the data, form new variables and then associate the food item data from the dog's puppyhood and adolescence with the diagnosis of conjunctivitis at adult age and see if any associations, positive or negative, could be found.

It was hypothesized that feeding fats would have a negative correlation with conjunctivitis, meaning that the more fat that the dog would eat, the less there would be conjunctivitis.

3. MATERIALS AND METHODS

3.1. Data materials

The Finnish DOGRISK questionnaire (Appendix 1) has been on the Internet since December 2009 (www.ruokintakysely.fi) where owners can fill information about the dogs they have or had. The data material used in this work was collected from Finnish dog population December 2009 until April 2015 and included feeding data from 6659 puppyhood diets and 5564 adolescent dog diets. The feeding data comes from what puppies were fed at 0-6 months and what adolescent dogs were fed at 6-18 months.

3.2. Questionnaire

3.2.1. Questions in the data

The questionnaire has questions about background information of the dog which includes for example age when they filled in the questionnaire, sex, season of birth, breed, coat color, vaccination, deworming and living conditions. Among the background information are also questions about the diseases the dog and its mother have suffered from as well as what the owner has been feeding the dog when it was a puppy, an adolescent and at the time of answering the questionnaire (adult).

Although the questionnaire includes a list of different diseases, this study focuses on eye diseases. This list included 26 different eye diseases but the diseases of interest in this study were number 14, conjunctivitis and number 23, eye inflammation.

54 different food items are listed in the questionnaire (Table 1), and the owner could choose how often the dog had eaten that item, from five different options. These options were “never”, “a few times per year”, “a few times per month”, “a few times per week”, and

"almost daily/daily". The owner could also write down if the dog had been given some other food items.

Table 1. Food items in the questionnaire

Dry food	Liver casserole	Bread
Canned food or sausage for dogs	Human meal leftovers/other human food	Gluten free bread
Special food for certain diseases	Fermented meat	Dry food given as treats
Fresh food for dogs (for example BARF)	Dried animal parts (for example pig or sheep ears, ox tails, dried chicken)	Dog biscuits
Cooked meat	Milk	Dried organs
Raw meat	Ice cream	Dried fish
Cooked organs	Milk products	Rawhides (not raw)
Raw organs	Cheese	Sticks outside
Cooked fish	Cooked vegetables	Carcasses outside
Raw fish	Raw vegetables	Grass outside
Cooked bones and cartilage	Fermented cereal	Soil outside
Raw bones and cartilage	Fermented vegetables	Clay, stones
Cooked beef tripe	Fruits	Water from puddles etc.
Raw beef tripe	Berries	Feces outside
Cooked egg	Rice	Vegetable oil
Raw egg	Other cereal products	Oils and fats of animal origin
Frankfurter, link sausage etc.	Potato	Oil products
Blood pancakes	Pasta, couscous	Yrjölän puro (porridge)

3.3. Data handling

3.3.1. Correction to data

Corrections were made to both puppy and adolescent dog tables as some owners had marked an eye disease code but had not marked the number 2 which meant that the dog had had the disease, so the number 2 was added. Also, if the owner had chosen an eye disease and explained when it started and how frequent it was but had not marked that the dog suffers from eye diseases (different variable), the dog was considered to have had an eye disease and the coding was changed accordingly. As a summary:

In the question of eye diseases in the puppy diet data 68 answers with missing information were corrected and in the dog's mother's disease list 6 missing answers were changed.

In the adolescent data 57 eye diseases were corrected. The same was done to the data of the adolescent dog's mother. Corrected answers were in total 17.

The eye diseases conjunctivitis and eye inflammation were put together as one variable as some veterinarians put eye inflammation as a diagnosis instead of conjunctivitis. Objects, like sticks, feces, clay and/or stones, that dogs can eat outside were left outside the survey because those the owner does not give to dog to eat but those the dog can freely choose to eat.

Food item files that were used were imputed, meaning that the data was changed so that both those that the owner has marked as never and those that there were not marked with anything, were counted as never. Only dogs where the energy amount was enough regarding what dogs ate per week, were included in the data that was used.

3.3.2. Final study population used in analysis

The total population of dogs that had a diet from their puppy age, collected between December 2009 - April 2015 was 6599. In figure 3 we see that dogs with missing information and other eye diseases were excluded, resulting in a whole study population of 5692 cases that had puppy age data, of which 553 has had conjunctivitis and 5139 were controls with no eye disease.

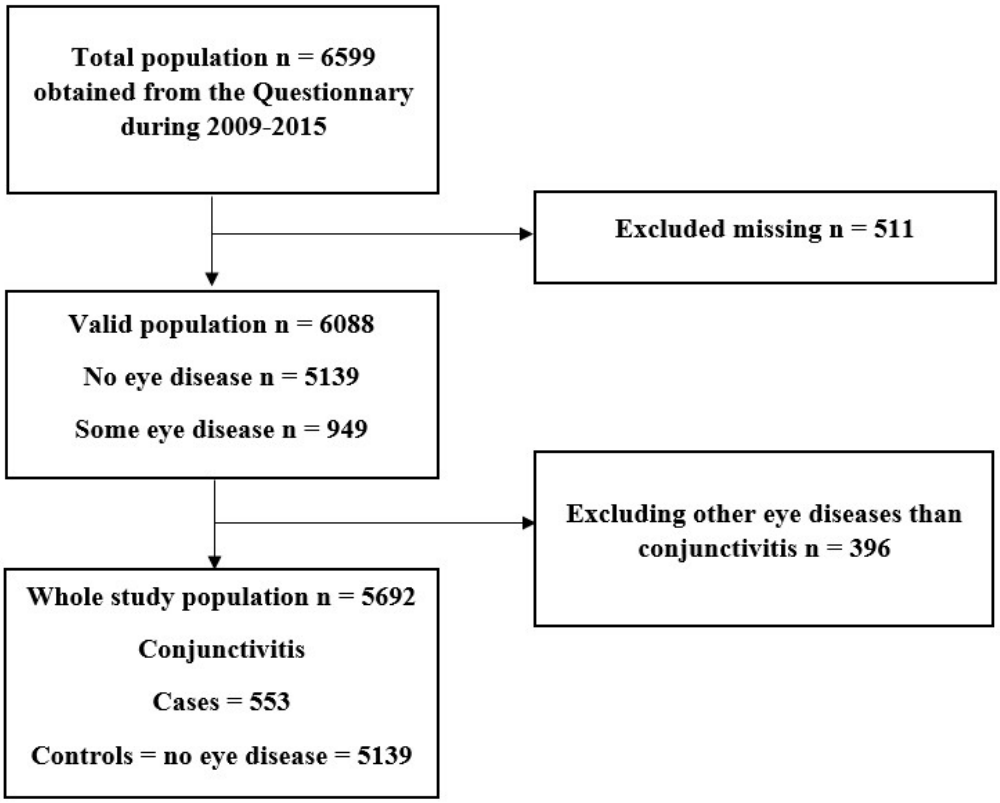

Figure 3. Flow chart of the study population of dogs that had puppy diet data.

The total population of dogs that adolescent diet data, collected between December 2009 - April 2015 was 5564. In figure 4 we see that dogs with missing information and other eye diseases were excluded, resulting in a whole study population of 4781 cases that had adolescent age data, of which 478 has had conjunctivitis and 4303 were controls with no eye disease.

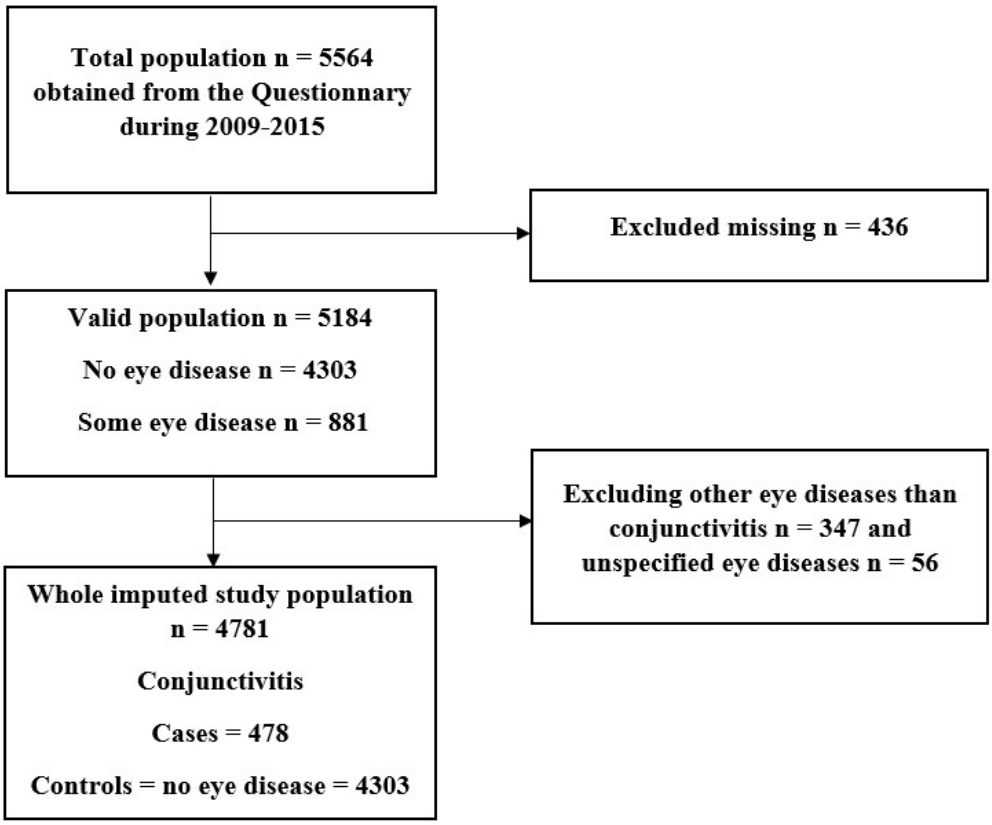

Figure 4. Flow chart of the study population of dogs with adolescent diet data.

3.4. Statistical analyses

Data manipulation and statistical analyses were done using SPSS 21.0 (IBM, New York, USA) and a p-value ≤0.05 was considered significant. Our dependent variable was ”has the dog suffered from conjunctivitis?: yes/no”.

The chi-square test was used to analyze associations between eye inflammation and different food items separately. All food items included in the analysis are presented in table 1. Where the univariate chi-square value was a maximum 0.2, those food items were put into a logistic regression model. For the final model a stepwise backward elimination procedure was used. Odds ratios (OR) with 95% confidence intervals (CI) are presented in the results of the models.

4. RESULTS

4.1. Descriptive statistics

There were 5692 dogs with puppy diet data and 4781 dogs with adolescent diet data in the study populations, of which there were 46.3% males and 53.7% females in the puppy diet data and 46.7% males and 53.3% females in the adolescent diet data.

The mean age (±SD) of the dogs in the puppy diet data was 3.72 years (±3.03) (Table 2). Figure 5 shows the age distribution of dogs in the puppy diet data meaning the age the dog was when the owner answered the questionnaire. The mean age of the dogs in the adolescent diet data was 3.87 years (±3.03). Figure 6 illustrates the age distribution of these dogs.

Table 2. Descriptive statistics of puppy and adolescent diet data

Statistics	Puppy diet data	Adolescent diet data
Number of dogs in the study	5692	4781
Males / females (%)	46.3 / 53.7	46.7 / 53.3
Mean age (±SD years)	3.72 ± 3.03	3.87 ± 3.03
Season of birth: winter / spring / summer / autumn (%)	24.5 / 30.3 / 24.0 / 21.3	24.5 / 31.2 / 23.1 / 21.2
Has had some eye disease (%) / No eye diseases	84.2 / 15.8	83 / 17
Has had / has not had conjunctivitis / eye inflammation (%)	90.3 / 9.7	90 / 10
Frequent / infrequent (%)	75.4 / 24.6	77.2 / 22.8

SD – standard deviation

The sex distribution is almost the same in the puppy and adolescent diet data. The age distribution in figure 5 shows that 23.3% of dogs were 1 year old at the time the owner has answered the questionnaire. When owners answered to the questionnaire about the adolescent diet, 24.4% of those dogs were at that moment 1 year old. Figure 6 shows the age of the dogs when the conjunctivitis appeared for the first time in the puppy diet data. The graph was very similar for the adolescent diet data. Season of birth is quite evenly distributed, almost 1/3 of dogs were born in spring and no big differences is in puppy versus adolescent data.

84.2% of dogs in the puppy diet data had had no eye diseases and 15.8% had had some eye disease. There were 90.3% of dogs in the puppy diet data that had had no conjunctivitis or eye inflammation and 9.7% that had had conjunctivitis and eye inflammation. In the puppy diet data the frequency of conjunctivitis of the dogs was divided as: infrequent in 75.4% and frequent in 24.6% of the dogs that suffered from it.

83% of adolescent have not had any eye disease and 17% have had some eye disease. Dogs in the adolescent diet population that have not had conjunctivitis or eye inflammation constitutes 90% and those that have had constitutes 10%. Frequency of eye disease in adolescent diet population is 77.2% infrequent and 22.8% frequent.

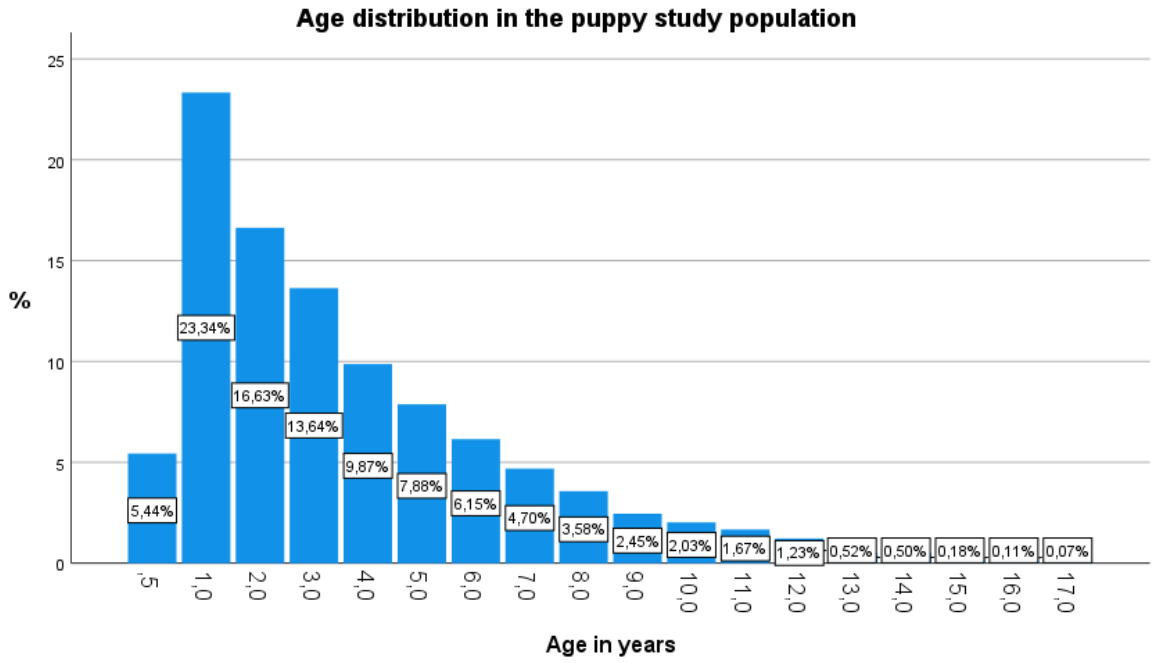

Figure 5. Age distribution in the puppy diet population at the responding time to the questionnaire.

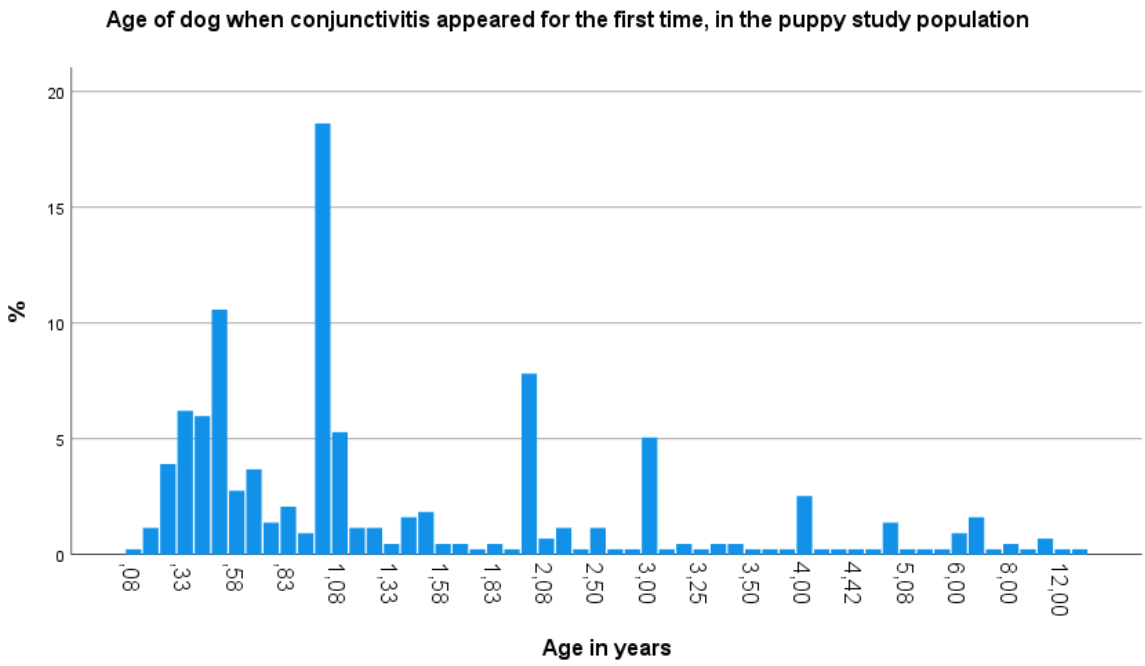

Figure 6. Age of dog when conjunctivitis appeared for the first time, in the puppy study population.

4.2. Associations of puppy eye disease with food

Out of the dogs that had answered questions about the puppy diet 9.9% had conjunctivitis and 48.4% had eye inflammation which makes a total of 58.3% of all eye diseases. Eye ulcers (7.7%) were also quite common diagnosis in the data on puppy diets (Figure 7).

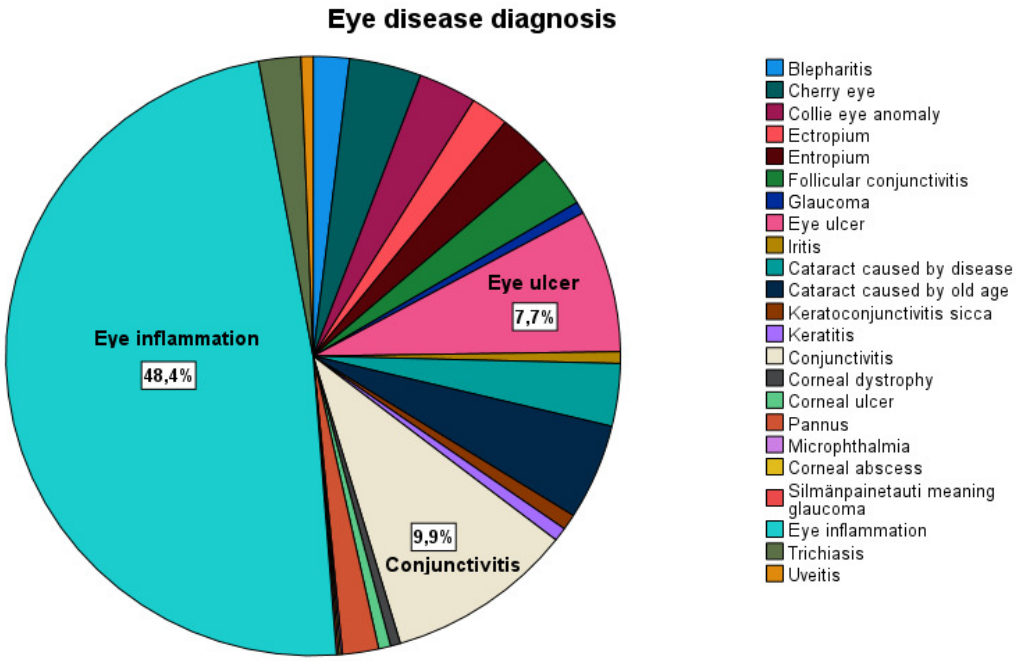

Figure 7. Eye diagnoses in dogs that had answered questions about the puppy diet.

231 dogs out of 949 (24.3%) still had the eye disease at the time when they answered to the questionnaire about the puppy time diet. 418 dogs had answered the question about if changing the diet had helped the eye disease. 63 dogs (15%) out of the 418 got help after changing the diet and the number that did not get help from changing the diet was 355 (85%).

Table 3. Results of univariate chi-square test results with p-value ≤0.20 of puppies (<1/year; n = 5692)

Food	**Never eats**		**Eats <1/year**		**p-value**
	n	Conjunctivitis % (95% CI)	n	Conjunctivitis % (95% CI)	
Berries	3486	9.5 (7.7-9.6)	2206	10.1 (8.9-11.4)	0.069
Cooked vegetables	3613	10.3 (9.4-11.4)	2079	8.7 (7.5-9.9)	0.197
Cheese	3008	9.0 (8.0-10.1)	2684	10.5 (9.4-11.7)	0.035
Animal fat	4918	10.0 (9.2-10.9)	774	8.0 (6.2-10.2)	0.055
Rice	1461	8.5 (7.1-10.0)	4231	10.1 (9.2-11.1)	0.092
Rawhides (not raw)	781	7.7 (5.9-9.8)	4911	10.0 (9.2-10.9)	0.173

CI – confidence interval

In table 3 the food items that had a significance of ≤0.20 is shown their p-values. There is also seen the number of dogs that never ate or ate more than once a year some food item and that had or did not have conjunctivitis. Dogs with conjunctivitis are presented as percent with 95% CI.

The study population has puppy diet data from 5713 dogs. Six food items had significance of ≤ 0.20 and positive correlation was seen in two of them, in cheese and rawhides. These food items were put into the logistic regression to get the final model.

In the final model there was a negative association between cooked vegetables (p = 0.009; OR = 0.911; 95% CI = 0.850–0.977) and conjunctivitis and between animal fat (p = 0.047; OR = 0.870; 95% CI = 0.759–0.998) and conjunctivitis.

When using non-imputed data, the results in the final logistic regression model were not similar. In the puppy diet data the final model gave one negative association which was animal fat, and it was not significant, only a trend (p = 0.082; OR = 0.847; CI 95% = 0.702–1.021)

4.3. Associations of adolescent eye disease with food

Eye inflammation 48.4% and conjunctivitis 9.6% makes a total of 58% of all eye disease diagnoses. Eye ulcers (8.2%) were also a quite common diagnosis in the data on adolescent diets (Figure 8).

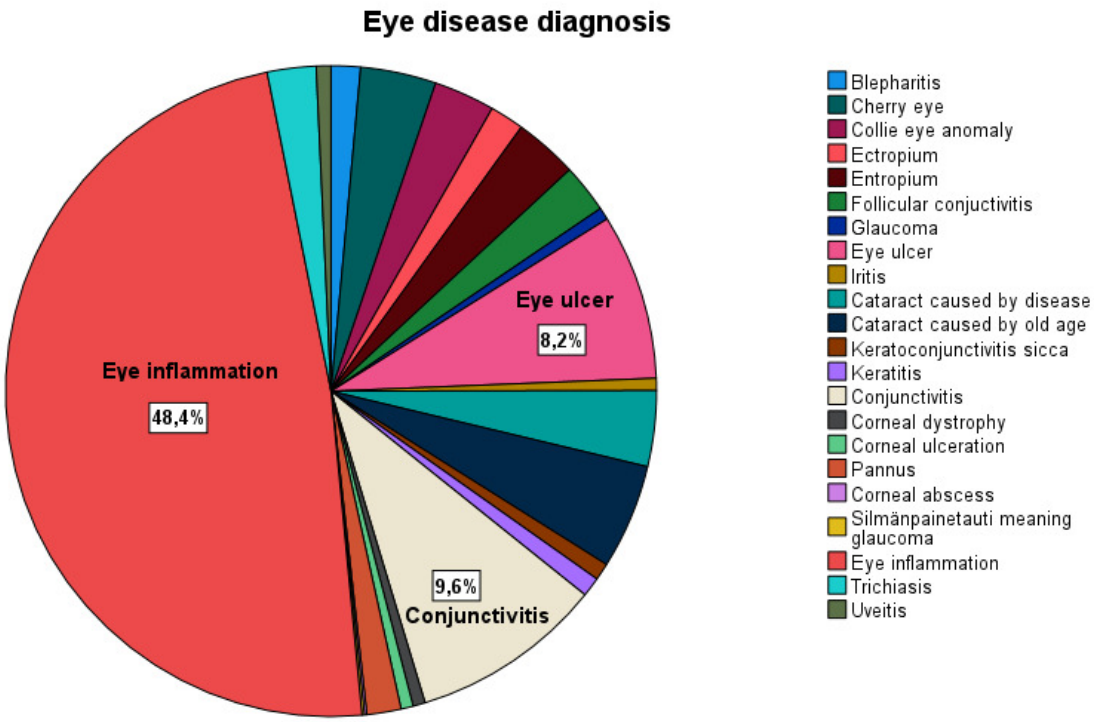

Figure 8. Eye disease diagnoses in the dogs that had answered questions about the adolescent diet.

200 dogs out of 881 (22.7%) still have the eye disease at the time the owner answered to the questionnaire. 58 dogs (15.8%) out of 366 got help after changing the diet and the eye disease ended and the number that did not get help from changing the diet was 308 dogs (84.2%).

The second study population has adolescent diet data from 4781 dogs. 16 food items had a significance of ≤0.20 and positive correlation was seen in five of them, in cooked bone and cartilage, sour milk products, dry dog food, rawhides, and treats. All these 16 food items were put into the logistic regression to get the final model. In table 4 the food items that had a significance of ≤ 0.20 and their p-values are shown. There is also seen the number of dogs that never ate or ate more than once a year some food item and that had or did not have conjunctivitis. Dogs with conjunctivitis are presented as percent with 95% CI.

In the final model the logistic regression gave for results raw bone and cartilage (p = 0.011; OR = 0.933; 95% CI = 0.885–0.984), human meal leftovers (p = 0.021; OR = 0.927; 95% CI = 0.870–0.989) and treats (p = 0.051; OR = 1.047; 95% CI = 1.000–1.096). There was a negative association between raw bone and cartilage and conjunctivitis as well as between

human meal leftovers and conjunctivitis. In treats there was a trend and almost statistically significant positive association between treats and conjunctivitis.

Table 4. Results of univariate chi-square test results with p-value ≤0.20 of adolescent dogs (>1/year; n = 4781)

Food	Never eats		Eats >1/year		p-value
	n	Conjunctivitis % (95% CI)	n	Conjunctivitis % (95% CI)	
Berries	2743	9.6 (8.5-10.7)	2038	10.6 (9.3-12.0)	0.069
Tripe raw	3244	10.6 (9.6-11.7)	1537	8.7 (7.3-10.2)	0.197
Organs raw	3735	10.2 (9.2-11.2)	1046	9.3 (7.6-11.2)	0.035
Bone cartilage cooked	2553	9.1 (8.0-10.3)	2228	11.0 (9.8-12.4)	0.055
Bone cartilage raw	1837	11.0 (9.6-12.5)	2944	9.4 (8.3-10.5)	0.092
Milk products sour	1402	9.1 (7.6-10.7)	3379	10.4 (9.4-11.5)	0.173
Milk products other	3020	10.2 (9.1-11.3)	1761	9.7 (8.4-11.2)	0.152
Fat fish	3228	10.3 (9.3-11.4)	1553	9.3 (7.9-10.9)	0.169
Dog food dry	583	9.1 (6.9-11.7)	4198	10.1 (9.2-11.1)	0.032
Dog food wet	2771	9.5 (8.4-10.6)	2010	10.7 (9.4-12.2)	0.200
Dog food special dry	4605	10.0 (9.1-10.9)	176	10.2 (6.2-15.7)	0.172
Human meal leftovers/other human food	1573	9.9 (8.5-11.5)	3208	10.0 (9.0-11.1)	0.179
Treats (dog treats, dog bisquits)	908	8.6 (6.8-10.6)	3873	10.3 (9.4-11.3)	0.037
Rawhides (not raw)	724	7.5 (5.7-9.6)	4057	10.5 (9.5-11.4)	0.088
Red meat raw	2153	9.5 (8.3-10.8)	2628	10.4 (9.3-11.7)	0.036
Red meat cooked	2864	9.2 (8.2-10.3)	1917	11.2 (9.8-12.7)	0.056

CI – confidence interval

In the final model the logistic regression gave for results raw bone and cartilage (p = 0.011; OR = 0.933; 95% CI = 0.885–0.984), human meal leftovers (p = 0.021; OR = 0.927; 95% CI = 0.870–0.989) and treats (p = 0.051; OR = 1.047; 95% CI = 1.000–1.096). There was a negative association between raw bone and cartilage and conjunctivitis as well as between human meal leftovers and conjunctivitis. In treats there was a trend and almost statistically significant positive association between treats and conjunctivitis.

When using non-imputed data, the results in the final logistic regression model were similar but not exactly the same. In the adolescent diet data the final model gave one negative association which was human meal leftovers (p = 0.043; OR = 0.911; CI 95% = 0.832–0.997). Positive association was between treats and conjunctivitis (p = 0.007; OR = 1.084; CI 95% = 1.022–1.150). Milk products were not significant (p = 0.123; OR = 0.778; CI 95% = 0.565–1.071).

5. DISCUSSION

Conjunctivitis in dogs is quite commonly seen in veterinary practice. In this study conjunctivitis/eye inflammation were also a quite common diagnosis in the dogs that had given data on the puppy time diet a total of 58.3% had conjunctivitis/eye inflammation and the same diagnosis in the dogs that had given adolescent diet data was 58%.

Distribution of sex and season of birth were almost the same in both study populations. These similarities could be explained by that the puppy and adolescent diet data have almost the same dog population. The mean age of dogs when the owners answered the questionnaire was approximately 3 years. This can be thought to be quite good because when the owners responded to questionnaire, the dog was not yet very old, they can better remember what they have been feeding to their dogs as puppy and as adolescent.

The aim of this study was to see if there were any negative or positive associations between conjunctivitis and the food items the puppies or adolescent ate, after curating the data and forming new variables. The final model results gave some guide about this as when puppies often ate animal fat or cooked vegetables as well as when adolescent dogs often ate human meal leftovers or raw bones and cartilage, they had less conjunctivitis. This means that those food items might have had a protective effect against conjunctivitis. However, the OR values in all results were quite close to 1 meaning the negative association between the food item and conjunctivitis is not that strong. When the OR is quite close to 1 the impact is probably small, and the final significance stays uncertain. In any case, to prove any cause relationship, prospective studies are needed.

Those dogs that were often eating often animal fats seem to have less conjunctivitis and this does support the hypothesis of this study. This could be because the dogs that have enough fat in their diet will have normal absorption of fat-soluble vitamins, especially Vitamin A. Fats also provide essential fatty acids, like linoleic acid (Delaney and Fascetti, 2011), as well as energy, and these will able its body to function well. Long-chained omega-3 fatty acids are good for eye health, also for dogs having KCS (Zhang *et al*., 2020), and those fatty acids

dogs can get when fed fish or fish oil. KCS is one possible cause for conjunctivitis and its good if fish oils are given to those dogs suffering from it. Those fatty acids have beneficial effects for inflammatory conditions like atopy and osteoarthritis (Bauer, 2011), and as dogs having atopic dermatitis can have allergic conjunctivitis (Gould and McLellan, 2014), they could also benefit from it.

Cooked vegetables showed a negative association to conjunctivitis. These can for example include carrots which contain carotenoids from which dogs can make vitamin A. Vegetables also contain dietary fiber which is needed for a normal functioning gastrointestinal tract. Fiber fermentation produces short-chain fatty acids which are needed as energy for colon mucosal cells (Case et al., 2011). These fibers dogs can get from cooked vegetables, like from carrots, potatoes, celery, beetroot and broccoli. Good sources of carotenoids and vitamin A, which are good for eye health, are carrots and sweet potatoes (Case et al., 2011).

The final model for adolescent dog diets showed that human meal leftovers and raw bones and cartilage had a negative association to conjunctivitis. Human meal leftovers given to dogs can include different food items like meat, egg, liver casseroles, vegetables, milk products, potato, cereals, rice and so on. Leftovers can contain lactic acid bacteria, different vitamins and minerals and omega-3 fatty acids. Some dogs which might have some slight deficiencies in the diet might not get that easily deficiencies if they eat leftovers. When thinking of eye health and vitamin A and omega-3 fatty acids, the following items at least contain those: fish and fish liver oil, liver, milk and egg yolk (Case *et al*., 2011), and at least some of these can be quite often included in leftovers. Leftovers containing for example carrots or liver will help dog to have Vitamin A. Wang *et al*. (2016) say that vitamin C also is important for the eye. It is somewhat unclear if the vitamin C that dogs can produce by themselves is enough.

Raw bones and cartilage are shown to clean the teeth. Raw bones contain phosphorus and calcium (Hall, 2015) and cartilage contains glucosamine and chondroitin sulphate which are used to treat osteoarthritis together with medicines (Henrotin *et al*., 2012). Chondroitin sulphate has anti-inflammatory activity (Bishnoi *et al*., 2016). Chicken wings and legs for example contain both bone and cartilage. Raw bones and cartilages are also used in dry food, but their composition and nutrients change during cooking.

A study of inflammatory bowel disease showed that raw feeding with high fat, moderate protein and low carbohydrate macronutrients decreases the risk of inflammatory bowel disease later in a dog's life. An increased association of having inflammatory bowel disease was seen when dry extruded food was given to dogs, meaning the food has low fat, moderate protein, and high carbohydrate macronutrients (Hemida *et al*., 2021). Immune system functions better when the gut microbiome is in balance, and the growth of the microbiome can be stimulated by raw meat-based diet (Sandri *et al*., 2017; Hemida *et al*., 2021). According to these studies raw bones and cartilage as well as fat can have an anti-inflammatory effect in the dog, and this might also have had a good impact on eye health.

There was a trend towards significance with eating treats, but the result did not reach significance. Treats like dog biscuits resemble human cookies because they are mostly made of carbohydrates with added flavor. Carbohydrates (transformed to sugars) eaten in higher amounts are known to be proinflammatory which together with other bad eating habits can lead to chronic inflammation in the human body (Giugliano *et al*., 2006). It would be interesting if more research would be done that would establish if there is a true positive association between conjunctivitis and treats fed to dogs.

There are limitations in this work. We did not study what happened in the different scenarios such as if the same dogs ate a certain diet as a puppy and a different diet as an adolescent, or the same food in both ages and if this would have had a different effect.

Another limitation of the study is that no covariates were tested in the regression models. Usually covariates such as age, breed, sex and environment should be used in the same model as foods. In this work, however, only modifiable variables were analyzed so the impact of the covariats remains unknown.

It is also a limitation of this study that if the dogs had eaten something as a puppy and then the owners have changed the given food items as a consequence of getting conjunctivitis and/or any other signs of a more complex disease, this would not have been seen in the adolescent diet data. Although there were significant associations between certain food items and conjunctivitis this does not approve causality. The associations should be tested in diet intervention studies.

CONCLUSIONS

Conjunctivitis is quite common eye disease in dogs, and it can be caused by many different reasons. Feeding has an important role for vision. Antioxidants; carotenoids and vitamin C; are shown to be good for retinal health and long-chain fatty acid DHA increases retinal function in young dogs.

This study showed that there was significance towards some food items that had a negative association against conjunctivitis, but the OR showed the association was not very strong. These food items might contain vitamins, carotenoids and omega-3 fatty acids needed for good eye health as well as anti-inflammatory properties. Further studies should be done to study the association between those food items and conjunctivitis.

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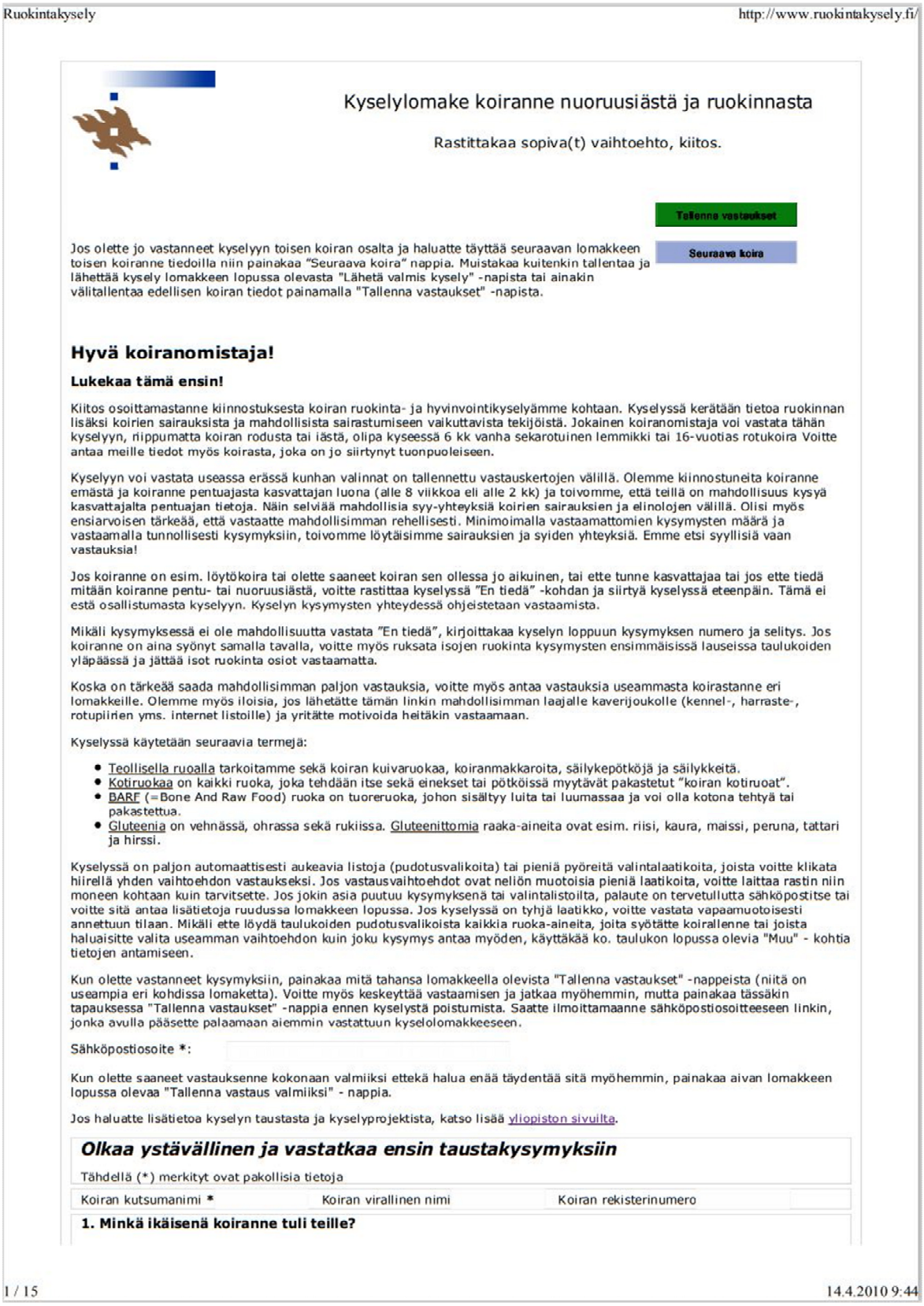
APPENDIXES

Appendix 1. Ruokintakysely. Feeding inquiry.



Ruokintakysely http://www.ruokintakysely.fi/

Kyselylomake koiranne nuoruusiästä ja ruokinnasta

Rastittakaa sopiva(t) vaihtoehto, kiitos.

Tallenna vastaukset

Seuraava koira

Jos olette jo vastanneet kyselyyn toisen koiran osalta ja haluatte täyttää seuraavan lomakkeen toisen koiranne tiedoilla niin painakaa "Seuraava koira" nappia. Muistakaa kuitenkin tallentaa ja lähettää kysely lomakkeen lopussa olevasta "Lähetä valmis kysely" -napista tai ainakin välitallentaa edellisen koiran tiedot painamalla "Tallenna vastaukset" -napista.

Hyvä koiranomistaja!

Lukekaa tämä ensin!

Kiitos osoittamastanne kiinnostuksesta koiran ruokinta- ja hyvinvointikyselyämme kohtaan. Kyselyssä kerätään tietoa ruokinnan lisäksi koirien sairauksista ja mahdollisista sairastumiseen vaikuttavista tekijöistä. Jokainen koiranomistaja voi vastata tähän kyselyyn, riippumatta koiran rodusta tai iästä, olipa kyseessä 6 kk vanha sekarotuinen lemmikki tai 16-vuotias rotukoira Voitte antaa meille tiedot myös koirasta, joka on jo siirtynyt tuonpuoleiseen.

Kyselyyn voi vastata useassa erässä kunhan valinnat on tallennettu vastauskertojen välillä. Olemme kiinnostuneita koiranne emästä ja koiranne pentuajasta kasvattajan luona (alle 8 viikkoa eli alle 2 kk) ja toivomme, että teillä on mahdollisuus kysyä kasvattajalta pentuajan tietoja. Näin selviää mahdollisia syy-yhteyksiä koirien sairauksien ja elinolojen välillä. Olisi myös ensiarvoisen tärkeää, että vastaatte mahdollisimman rehellisesti. Minimoimalla vastaamattomien kysymysten määrä ja vastaamalla tunnollisesti kysymyksiin, toivomme löytäisimme sairauksien ja syiden yhteyksiä. Emme etsi syyllisiä vaan vastauksia!

Jos koiranne on esim. löytökoira tai olette saaneet koiran sen ollessa jo aikuinen, tai ette tunne kasvattajaa tai jos ette tiedä mitään koiranne pentu- tai nuoruusiästä, voitte rastittaa kyselyssä "En tiedä" -kohdan ja siirtyä kyselyssä eteenpäin. Tämä ei estä osallistumasta kyselyyn. Kyselyn kysymysten yhteydessä ohjeistetaan vastaamista.

Mikäli kysymyksessä ei ole mahdollisuutta vastata "En tiedä", kirjoittakaa kyselyn loppuun kysymyksen numero ja selitys. Jos koiranne on aina syönyt samalla tavalla, voitte myös ruksata isojen ruokinta kysymysten ensimmäisissä lauseissa taulukoiden yläpäässä ja jättää isot ruokinta osiot vastaamatta.

Koska on tärkeää saada mahdollisimman paljon vastauksia, voitte myös antaa vastauksia useammasta koirastanne eri lomakkeille. Olemme myös iloisia, jos lähetätte tämän linkin mahdollisimman laajalle kaverijoukolle (kennel-, harraste-, rotupiirien yms. internet listoille) ja yritätte motivoida heitäkin vastaamaan.

Kyselyssä käytetään seuraavia termejä:

- Teollisella ruoalla tarkoitamme sekä koiran kuivaruokaa, koiranmakkaroita, säilykepötköjä ja säilykkeitä.
- Kotiruokaa on kaikki ruoka, joka tehdään itse sekä einekset tai pötköissä myytävät pakastetut "koiran kotiruoat".
- BARF (=Bone And Raw Food) ruoka on tuoreruoka, johon sisältyy luita tai luumassaa ja voi olla kotona tehtyä tai pakastettua.
- Gluteenia on vehnässä, ohrassa sekä rukiissa. Gluteenittomia raaka-aineita ovat esim. riisi, kaura, maissi, peruna, tattari ja hirssi.

Kyselyssä on paljon automaattisesti aukeavia listoja (pudotusvalikoita) tai pieniä pyöreitä valintalaatikoita, joista voitte klikata hiirellä yhden vaihtoehdon vastaukseksi. Jos vastausvaihtoehdot ovat neliön muotoisia pieniä laatikoita, voitte laittaa rastin niin moneen kohtaan kuin tarvitsette. Jos jokin asia puuttuu kysymyksenä tai valintalistoilta, palaute on tervetullutta sähköpostitse tai voitte sitä antaa lisätietoja ruudussa lomakkeen lopussa. Jos kyselyssä on tyhjä laatikko, voitte vastata vapaamuotoisesti annettuun tilaan. Mikäli ette löydä taulukoiden pudotusvalikoista kaikkia ruoka-aineita, joita syötätte koirallenne tai joista haluaisitte valita useamman vaihtoehdon kuin joku kysymys antaa myöden, käyttäkää ko. taulukon lopussa olevia "Muu" - kohtia tietojen antamiseen.

Kun olette vastanneet kysymyksiin, painakaa mitä tahansa lomakkeella olevista "Tallenna vastaukset" -nappeista (niitä on useampia eri kohdissa lomaketta). Voitte myös keskeyttää vastaamisen ja jatkaa myöhemmin, mutta painakaa tässäkin tapauksessa "Tallenna vastaukset" -nappia ennen kyselystä poistumista. Saatte ilmoittamaanne sähköpostiosoitteeseen linkin, jonka avulla pääsette palaamaan aiemmin vastattuun kyselolomakkeeseen.

Sähköpostiosoite *:

Kun olette saaneet vastauksenne kokonaan valmiiksi ettekä halua enää täydentää sitä myöhemmin, painakaa aivan lomakkeen lopussa olevaa "Tallenna vastaus valmiiksi" - nappia.

Jos haluatte lisätietoa kyselyn taustasta ja kyselyprojektista, katso lisää yliopiston sivuilta.

Olkaa ystävällinen ja vastatkaa ensin taustakysymyksiin

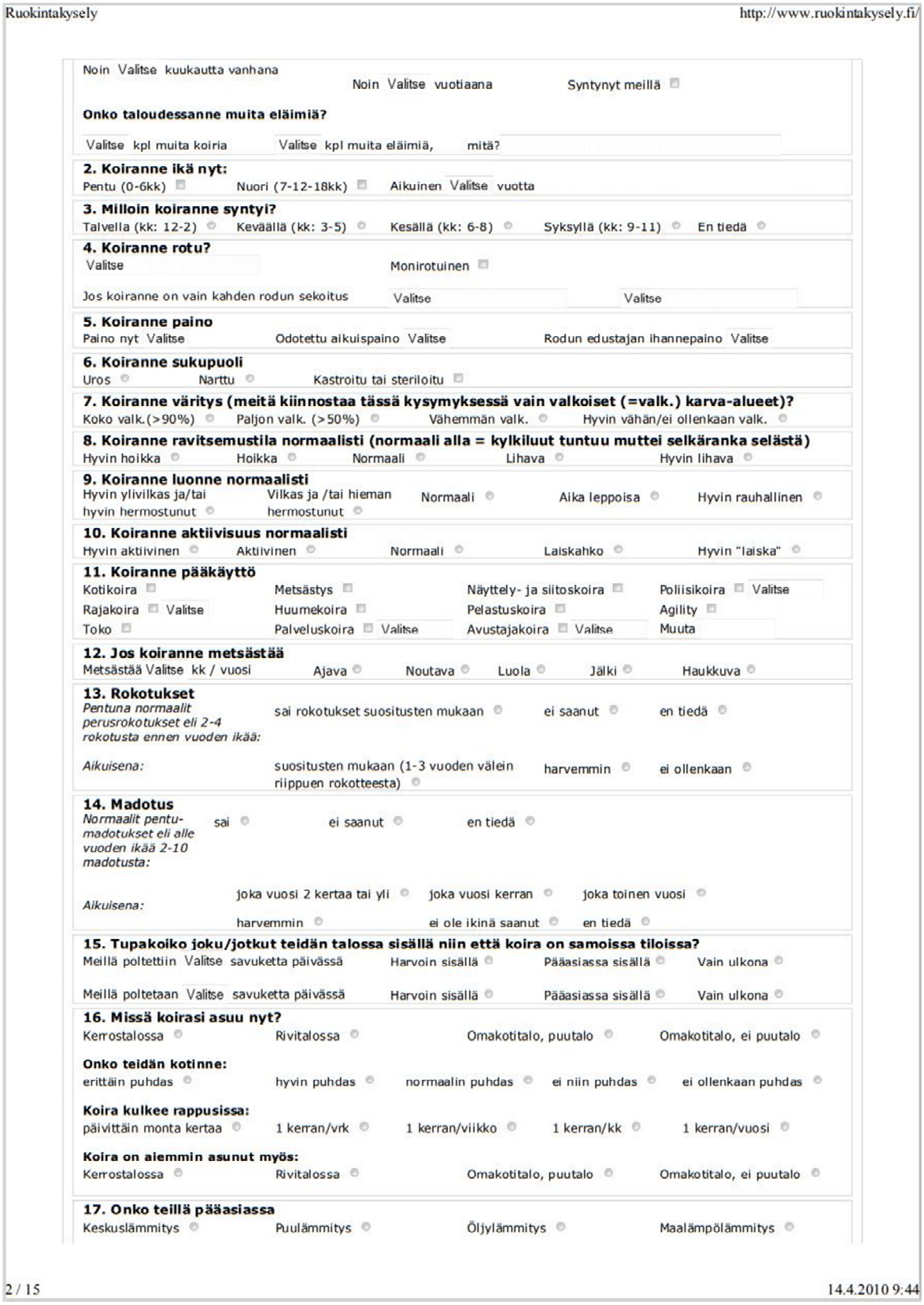
Tähdellä (*) merkityt ovat pakollisia tietoja

Koiran kutsumanimi * | Koiran virallinen nimi | Koiran rekisterinumero

1. Minkä ikäisenä koiranne tuli teille?

1 / 15 14.4.2010 9:44

Appendix 1 continued



Ruokintakysely http://www.ruokintakysely.fi/

Noin Valitse kuukautta vanhana Noin Valitse vuotiaana Syntynyt meillä

Onko taloudessanne muita eläimiä?

Valitse kpl muita koiria Valitse kpl muita eläimiä, mitä?

2. Koiranne ikä nyt:
Pentu (0-6kk) Nuori (7-12-18kk) Aikuinen Valitse vuotta

3. Milloin koiranne syntyi?
Talvella (kk: 12-2) Keväällä (kk: 3-5) Kesällä (kk: 6-8) Syksyllä (kk: 9-11) En tiedä

4. Koiranne rotu?
Valitse Monirotuinen

Jos koiranne on vain kahden rodun sekoitus Valitse Valitse

5. Koiranne paino
Paino nyt Valitse Odotettu aikuispaino Valitse Rodun edustajan ihannepaino Valitse

6. Koiranne sukupuoli
Uros Narttu Kastroitu tai steriloitu

7. Koiranne väritys (meitä kiinnostaa tässä kysymyksessä vain valkoiset (=valk.) karva-alueet)?
Koko valk.(>90%) Paljon valk. (>50%) Vähemmän valk. Hyvin vähän/ei ollenkaan valk.

8. Koiranne ravitsemustila normaalisti (normaali alla = kylkiluut tuntuu muttei selkäranka selästä)
Hyvin hoikka Hoikka Normaali Lihava Hyvin lihava

9. Koiranne luonne normaalisti
Hyvin ylivilkas ja/tai hyvin hermostunut Vilkas ja /tai hieman hermostunut Normaali Aika leppoisa Hyvin rauhallinen

10. Koiranne aktiivisuus normaalisti
Hyvin aktiivinen Aktiivinen Normaali Laiskahko Hyvin "laiska"

11. Koiranne pääkäyttö
Kotikoira Metsästys Näyttely- ja siitoskoira Poliisikoira Valitse
Rajakoira Valitse Huumekoira Pelastuskoira Agility
Toko Palveluskoira Valitse Avustajakoira Valitse Muuta

12. Jos koiranne metsästää
Metsästää Valitse kk / vuosi Ajava Noutava Luola Jälki Haukkuva

13. Rokotukset
Pentuna normaalit perusrokotukset eli 2-4 rokotusta ennen vuoden ikää: sai rokotukset suositusten mukaan ei saanut en tiedä

Aikuisena: suositusten mukaan (1-3 vuoden välein riippuen rokotteesta) harvemmin ei ollenkaan

14. Madotus
Normaalit pentu-madotukset eli alle vuoden ikää 2-10 madotusta: sai ei saanut en tiedä

Aikuisena: joka vuosi 2 kertaa tai yli joka vuosi kerran joka toinen vuosi
harvemmin ei ole ikinä saanut en tiedä

15. Tupakoiko joku/jotkut teidän talossa sisällä niin että koira on samoissa tiloissa?
Meillä poltettiin Valitse savuketta päivässä Harvoin sisällä Pääasiassa sisällä Vain ulkona
Meillä poltetaan Valitse savuketta päivässä Harvoin sisällä Pääasiassa sisällä Vain ulkona

16. Missä koirasi asuu nyt?
Kerrostalossa Rivitalossa Omakotitalo, puutalo Omakotitalo, ei puutalo

Onko teidän kotinne:
erittäin puhdas hyvin puhdas normaalin puhdas ei niin puhdas ei ollenkaan puhdas

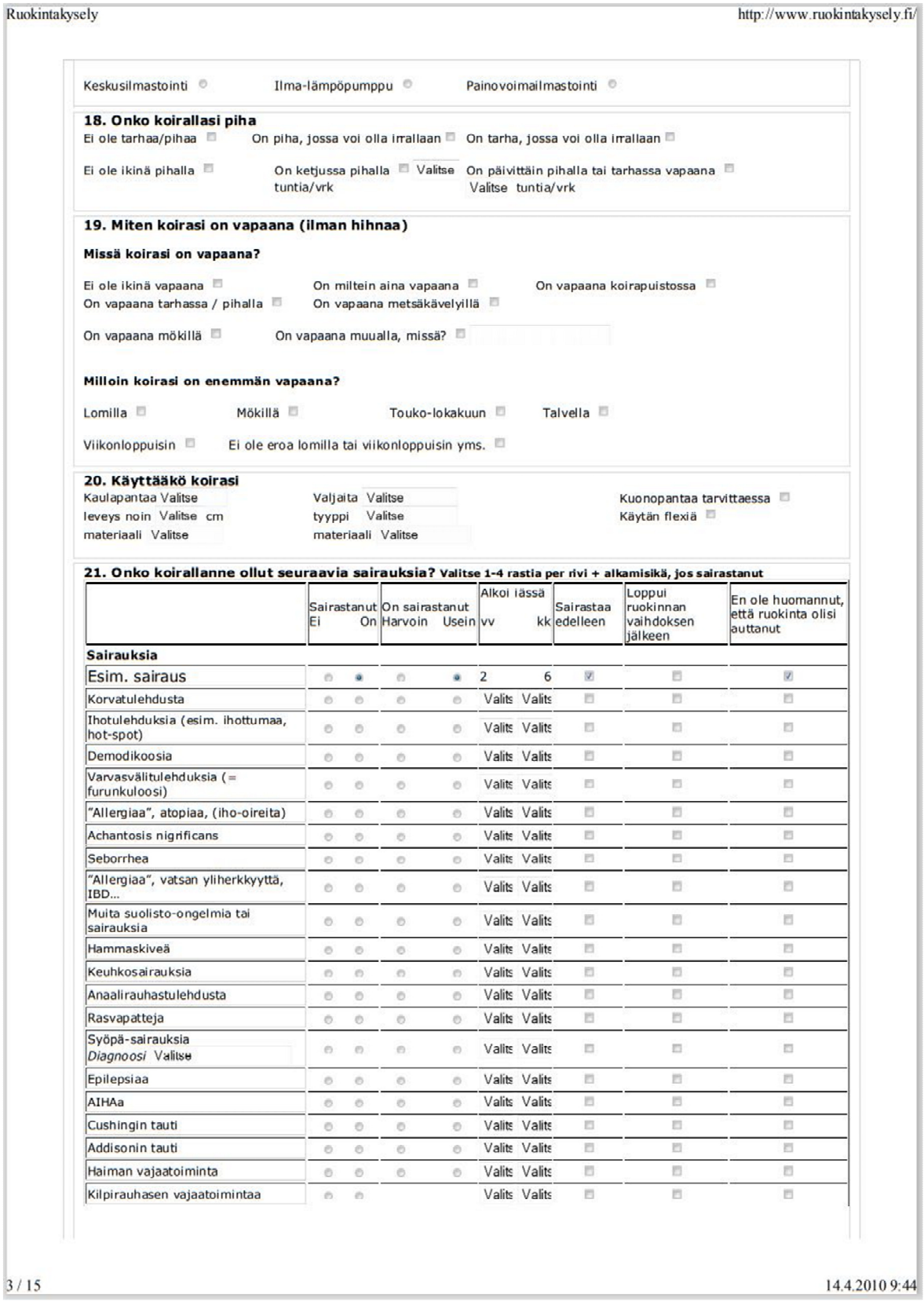
Koira kulkee rappusissa:
päivittäin monta kertaa 1 kerran/vrk 1 kerran/viikko 1 kerran/kk 1 kerran/vuosi

Koira on aiemmin asunut myös:
Kerrostalossa Rivitalossa Omakotitalo, puutalo Omakotitalo, ei puutalo

17. Onko teillä pääasiassa
Keskuslämmitys Puulämmitys Öljylämmitys Maalämpölämmitys

2 / 15 14.4.2010 9:44

Appendix 1 continued



Ruokintakysely http://www.ruokintakysely.fi/

Keskusilmastointi ○ Ilma-lämpöpumppu ○ Painovoimailmastointi ○

18. Onko koirallasi piha

Ei ole tarhaa/pihaa ☐ On piha, jossa voi olla irrallaan ☐ On tarha, jossa voi olla irrallaan ☐

Ei ole ikinä pihalla ☐ On ketjussa pihalla ☐ Valitse tuntia/vrk On päivittäin pihalla tai tarhassa vapaana ☐ Valitse tuntia/vrk

19. Miten koirasi on vapaana (ilman hihnaa)

Missä koirasi on vapaana?

Ei ole ikinä vapaana ☐ On miltein aina vapaana ☐ On vapaana koirapuistossa ☐

On vapaana tarhassa / pihalla ☐ On vapaana metsäkävelyillä ☐

On vapaana mökillä ☐ On vapaana muualla, missä? ☐

Milloin koirasi on enemmän vapaana?

Lomilla ☐ Mökillä ☐ Touko-lokakuun ☐ Talvella ☐

Viikonloppuisin ☐ Ei ole eroa lomilla tai viikonloppuisin yms. ☐

20. Käyttääkö koirasi

Kaulapantaa Valitse Valjaita Valitse Kuonopantaa tarvittaessa ☐

leveys noin Valitse cm tyyppi Valitse Käytän flexiä ☐

materiaali Valitse materiaali Valitse

21. Onko koirallanne ollut seuraavia sairauksia? Valitse 1-4 rastia per rivi + alkamisikä, jos sairastanut

	Sairastanut Ei	On	On sairastanut Harvoin	Usein	Alkoi iässä vv	kk	Sairastaa edelleen	Loppui ruokinnan vaihdoksen jälkeen	En ole huomannut, että ruokinta olisi auttanut
Sairauksia									
Esim. sairaus	○	●	○	●	2	6	☑	☐	☑
Korvatulehdusta	○	○	○	○	Valits	Valits	☐	☐	☐
Ihotulehduksia (esim. ihottumaa, hot-spot)	○	○	○	○	Valits	Valits	☐	☐	☐
Demodikoosia	○	○	○	○	Valits	Valits	☐	☐	☐
Varvasvälitulehduksia (= furunkuloosi)	○	○	○	○	Valits	Valits	☐	☐	☐
"Allergiaa", atopiaa, (iho-oireita)	○	○	○	○	Valits	Valits	☐	☐	☐
Achantosis nigrificans	○	○	○	○	Valits	Valits	☐	☐	☐
Seborrhea	○	○	○	○	Valits	Valits	☐	☐	☐
"Allergiaa", vatsan yliherkkyyttä, IBD...	○	○	○	○	Valits	Valits	☐	☐	☐
Muita suolisto-ongelmia tai sairauksia	○	○	○	○	Valits	Valits	☐	☐	☐
Hammaskiveä	○	○	○	○	Valits	Valits	☐	☐	☐
Keuhkosairauksia	○	○	○	○	Valits	Valits	☐	☐	☐
Anaalirauhastulehdusta	○	○	○	○	Valits	Valits	☐	☐	☐
Rasvapatteja	○	○	○	○	Valits	Valits	☐	☐	☐
Syöpä-sairauksia *Diagnoosi* Valitse	○	○	○	○	Valits	Valits	☐	☐	☐
Epilepsiaa	○	○	○	○	Valits	Valits	☐	☐	☐
AIHAa	○	○	○	○	Valits	Valits	☐	☐	☐
Cushingin tauti	○	○	○	○	Valits	Valits	☐	☐	☐
Addisonin tauti	○	○	○	○	Valits	Valits	☐	☐	☐
Haiman vajaatoiminta	○	○	○	○	Valits	Valits	☐	☐	☐
Kilpirauhasen vajaatoimintaa	○	○			Valits	Valits	☐	☐	☐

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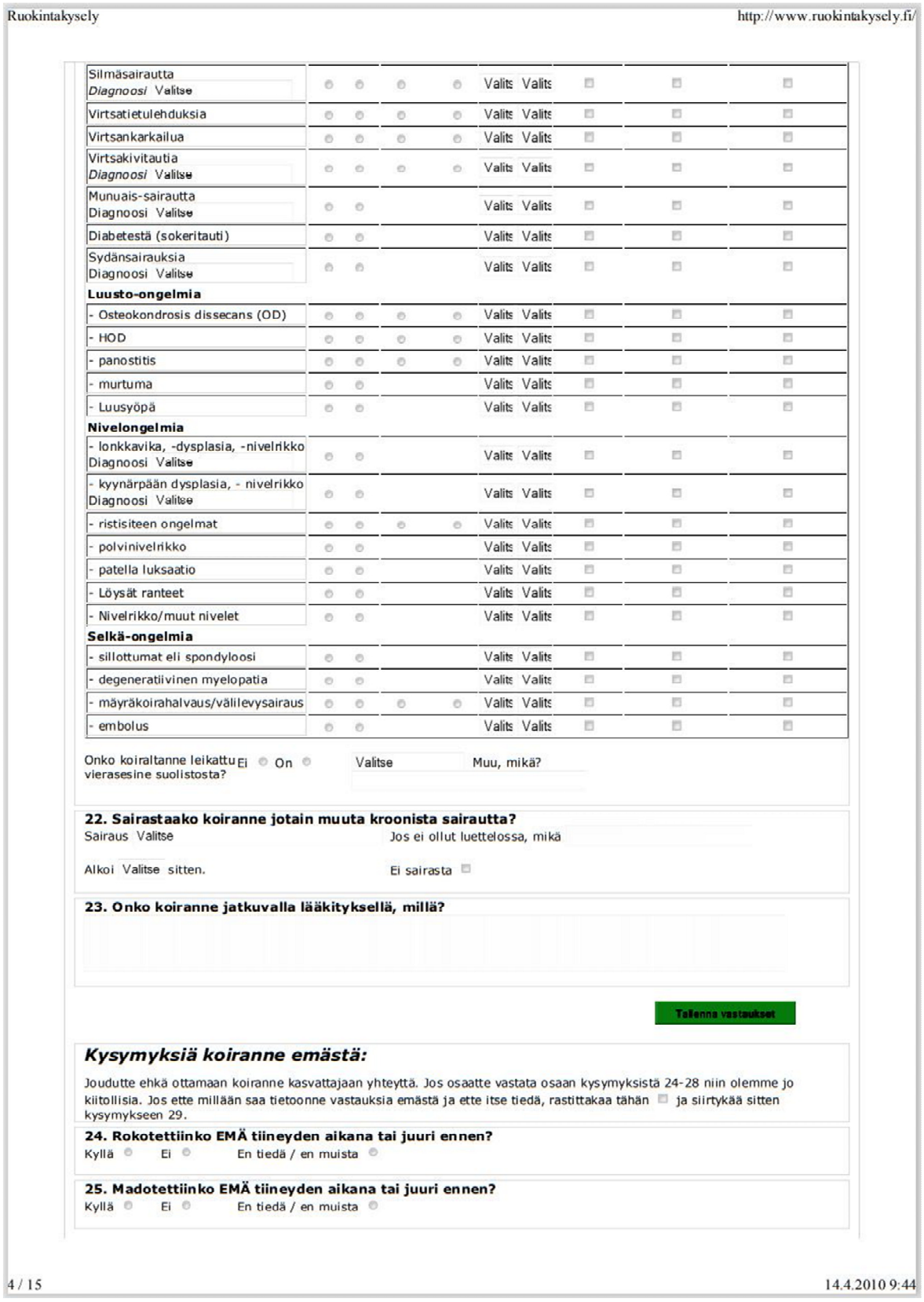
Appendix 1 continued



Ruokintakysely http://www.ruokintakysely.fi/

Silmäsairautta *Diagnoosi* Valitse	○	○	○	○	Valits	Valits	□	□	□
Virtsatietulehduksia	○	○	○	○	Valits	Valits	□	□	□
Virtsankarkailua	○	○	○	○	Valits	Valits	□	□	□
Virtsakivitautia *Diagnoosi* Valitse	○	○	○	○	Valits	Valits	□	□	□
Munuais-sairautta Diagnoosi Valitse	○	○			Valits	Valits	□	□	□
Diabetestä (sokeritauti)	○	○			Valits	Valits	□	□	□
Sydänsairauksia Diagnoosi Valitse	○	○			Valits	Valits	□	□	□
Luusto-ongelmia									
- Osteokondrosis dissecans (OD)	○	○	○	○	Valits	Valits	□	□	□
- HOD	○	○	○	○	Valits	Valits	□	□	□
- panostitis	○	○	○	○	Valits	Valits	□	□	□
- murtuma	○	○			Valits	Valits	□	□	□
- Luusyöpä	○	○			Valits	Valits	□	□	□
Nivelongelmia									
- lonkkavika, -dysplasia, -nivelrikko Diagnoosi Valitse	○	○			Valits	Valits	□	□	□
- kyynärpään dysplasia, - nivelrikko Diagnoosi Valitse	○	○			Valits	Valits	□	□	□
- ristisiteen ongelmat	○	○	○	○	Valits	Valits	□	□	□
- polvinivelrikko	○	○			Valits	Valits	□	□	□
- patella luksaatio	○	○			Valits	Valits	□	□	□
- Löysät ranteet	○	○			Valits	Valits	□	□	□
- Nivelrikko/muut nivelet	○	○			Valits	Valits	□	□	□
Selkä-ongelmia									
- sillottumat eli spondyloosi	○	○			Valits	Valits	□	□	□
- degeneratiivinen myelopatia	○	○			Valits	Valits	□	□	□
- mäyräkoirahalvaus/välilevysairaus	○	○	○	○	Valits	Valits	□	□	□
- embolus	○	○			Valits	Valits	□	□	□

Onko koiraltanne leikattu vierasesine suolistosta? Ei ○ On ○ Valitse Muu, mikä?

22. Sairastaako koiranne jotain muuta kroonista sairautta?

Sairaus Valitse Jos ei ollut luettelossa, mikä

Alkoi Valitse sitten. Ei sairasta □

23. Onko koiranne jatkuvalla lääkityksellä, millä?

Tallenna vastaukset

Kysymyksiä koiranne emästä:

Joudutte ehkä ottamaan koiranne kasvattajaan yhteyttä. Jos osaatte vastata osaan kysymyksistä 24-28 niin olemme jo kiitollisia. Jos ette millään saa tietoonne vastauksia emästä ja ette itse tiedä, rastittakaa tähän □ ja siirtykää sitten kysymykseen 29.

24. Rokotettiinko EMÄ tiineyden aikana tai juuri ennen?

Kyllä ○ Ei ○ En tiedä / en muista ○

25. Madotettiinko EMÄ tiineyden aikana tai juuri ennen?

Kyllä ○ Ei ○ En tiedä / en muista ○

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26. Muistatko/tiedätkö mitä koirasi EMÄ söi koirasi tiineyden aikana?
Lähinnä kotiruokaa ○ Lähinnä teollista muonaa ○ Sekoitus molemmista ○ En tiedä / en muista ○

Muistatko mitä

Arvioitko että se oli gluteenitonta? Kyllä ○ Ei ○ En tiedä / en muista ○

27. Muistatko/tiedätkö mitä koirasi EMÄ söi koirasi imetysajan aikana?
Lähinnä kotiruokaa ○ Lähinnä teollista muonaa ○ Sekoitus molemmista ○ En tiedä / en muista ○

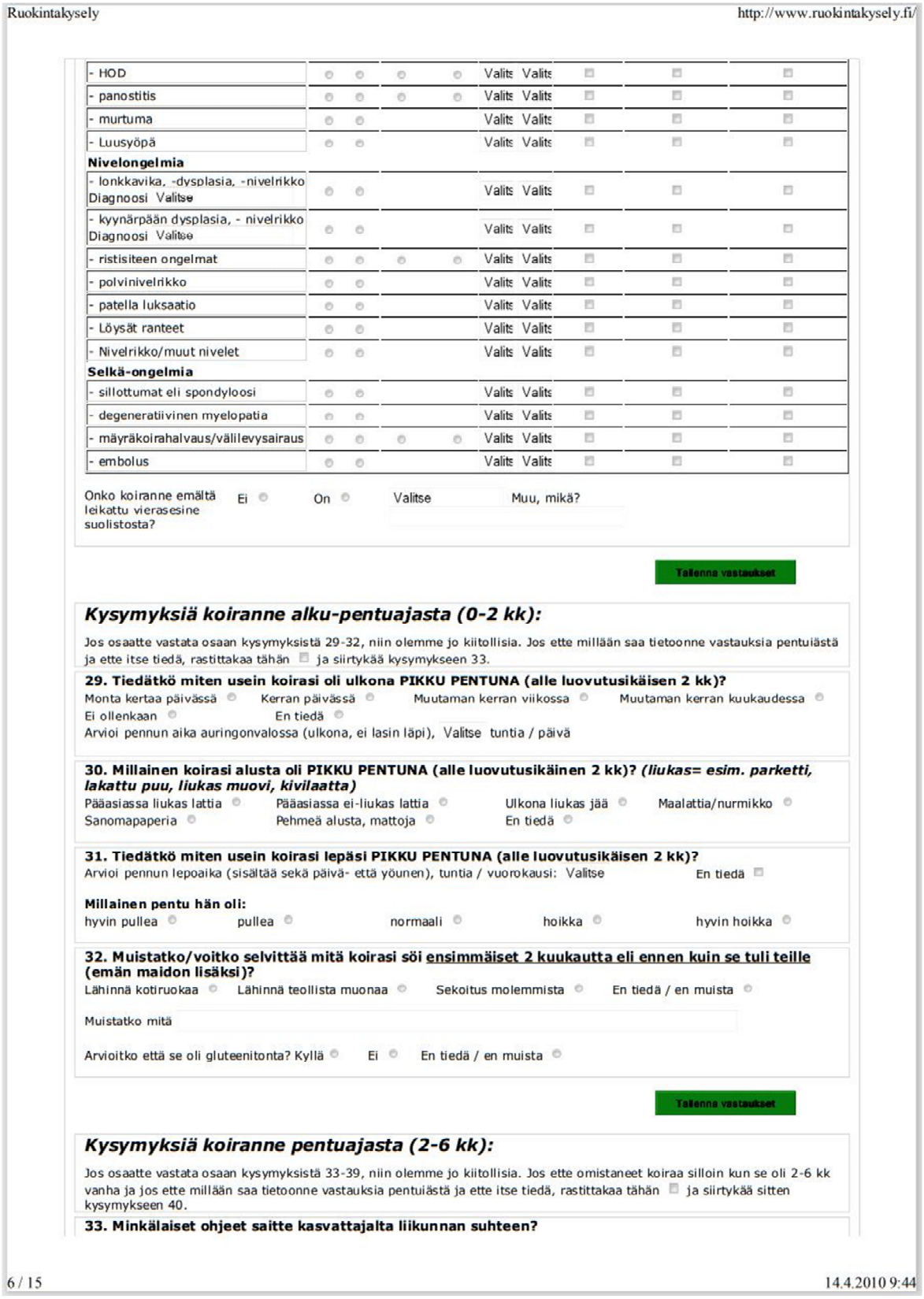
Muistatko mitä

Arvioitko että se oli gluteenitonta? Kyllä ○ Ei ○ En tiedä / en muista ○

28. Tiedättekö, onko koiranne EMÄ sairastanut seuraavia sairauksia? Valitse 1-4 rastia per rivi + alkamisikä, jos sairastanut

	Sairastanut Ei	On	On sairastanut Harvoin	Usein	Alkoi iässä vv	kk	Sairastaa edelleen	Loppui ruokinnan vaihdoksen jälkeen	En ole huomannut, että ruokinta olisi auttanut
Sairauksia									
Esim. sairaus	●	○	○	●	2	6	☑	☐	☑
Korvatulehdusta	○	○	○	○	Valits	Valits	☐	☐	☐
Ihotulehduksia (esim. ihottumaa, hot-spot)	○	○	○	○	Valits	Valits	☐	☐	☐
Demodikoosia	○	○	○	○	Valits	Valits	☐	☐	☐
Varvasvälitulehduksia (= furunkuloosi)	○	○	○	○	Valits	Valits	☐	☐	☐
"Allergiaa", atopiaa, (iho-oireita)	○	○	○	○	Valits	Valits	☐	☐	☐
Achantosis nigrificans	○	○	○	○	Valits	Valits	☐	☐	☐
Seborrhea	○	○	○	○	Valits	Valits	☐	☐	☐
"Allergiaa", vatsan yliherkkyyttä, IBD...	○	○	○	○	Valits	Valits	☐	☐	☐
Muita suolisto-ongelmia tai sairauksia	○	○	○	○	Valits	Valits	☐	☐	☐
Hammaskiveä	○	○	○	○	Valits	Valits	☐	☐	☐
Keuhkosairauksia	○	○	○	○	Valits	Valits	☐	☐	☐
Anaalirauhastulehdusta	○	○	○	○	Valits	Valits	☐	☐	☐
Rasvapatteja	○	○	○	○	Valits	Valits	☐	☐	☐
Syöpä-sairauksia *Diagnoosi* Valitse	○	○	○	○	Valits	Valits	☐	☐	☐
Epilepsiaa	○	○	○	○	Valits	Valits	☐	☐	☐
AIHAa	○	○	○	○	Valits	Valits	☐	☐	☐
Cushingin tauti	○	○	○	○	Valits	Valits	☐	☐	☐
Addisonin tauti	○	○	○	○	Valits	Valits	☐	☐	☐
Haiman vajaatoiminta	○	○	○	○	Valits	Valits	☐	☐	☐
Kilpirauhasen vajaatoimintaa	○	○			Valits	Valits	☐	☐	☐
Silmäsairautta *Diagnoosi* Valitse	○	○	○	○	Valits	Valits	☐	☐	☐
Virtsatietulehduksia	○	○	○	○	Valits	Valits	☐	☐	☐
Virtsankarkailua	○	○	○	○	Valits	Valits	☐	☐	☐
Virtsakivitautia *Diagnoosi* Valitse	○	○	○	○	Valits	Valits	☐	☐	☐
Munuais-sairautta Diagnoosi Valitse	○	○			Valits	Valits	☐	☐	☐
Diabetestä (sokeritauti)	○	○			Valits	Valits	☐	☐	☐
Sydänsairauksia Diagnoosi Valitse	○	○			Valits	Valits	☐	☐	☐
Luusto-ongelmia									
- Osteokondrosis dissecans (OD)	○	○	○	○	Valits	Valits	☐	☐	☐

Appendix 1 continued



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- HOD					Valits	Valits			
- panostitis					Valits	Valits			
- murtuma					Valits	Valits			
- Luusyöpä					Valits	Valits			
Nivelongelmia									
- lonkkavika, -dysplasia, -nivelrikko Diagnoosi Valitse					Valits	Valits			
- kyynärpään dysplasia, - nivelrikko Diagnoosi Valitse					Valits	Valits			
- ristisiteen ongelmat					Valits	Valits			
- polvinivelrikko					Valits	Valits			
- patella luksaatio					Valits	Valits			
- Löysät ranteet					Valits	Valits			
- Nivelrikko/muut nivelet					Valits	Valits			
Selkä-ongelmia									
- sillottumat eli spondyloosi					Valits	Valits			
- degeneratiivinen myelopatia					Valits	Valits			
- mäyräkoirahalvaus/välilevysairaus					Valits	Valits			
- embolus					Valits	Valits			

Onko koiranne emältä leikattu vierasesine suolistosta? Ei On Valitse Muu, mikä?

Tallenna vastaukset

Kysymyksiä koiranne alku-pentuajasta (0-2 kk):

Jos osaatte vastata osaan kysymyksistä 29-32, niin olemme jo kiitollisia. Jos ette millään saa tietoonne vastauksia pentuiästä ja ette itse tiedä, rastittakaa tähän ja siirtykää kysymykseen 33.

29. Tiedätkö miten usein koirasi oli ulkona PIKKU PENTUNA (alle luovutusikäisen 2 kk)?

Monta kertaa päivässä Kerran päivässä Muutaman kerran viikossa Muutaman kerran kuukaudessa Ei ollenkaan En tiedä

Arvioi pennun aika auringonvalossa (ulkona, ei lasin läpi), Valitse tuntia / päivä

30. Millainen koirasi alusta oli PIKKU PENTUNA (alle luovutusikäinen 2 kk)? *(liukas= esim. parketti, lakattu puu, liukas muovi, kivilaatta)*

Pääasiassa liukas lattia Pääasiassa ei-liukas lattia Ulkona liukas jää Maalattia/nurmikko Sanomapaperia Pehmeä alusta, mattoja En tiedä

31. Tiedätkö miten usein koirasi lepäsi PIKKU PENTUNA (alle luovutusikäisen 2 kk)?

Arvioi pennun lepoaika (sisältää sekä päivä- että yöunen), tuntia / vuorokausi: Valitse En tiedä

Millainen pentu hän oli:

hyvin pullea pullea normaali hoikka hyvin hoikka

32. Muistatko/voitko selvittää mitä koirasi söi ensimmäiset 2 kuukautta eli ennen kuin se tuli teille (emän maidon lisäksi)?

Lähinnä kotiruokaa Lähinnä teollista muonaa Sekoitus molemmista En tiedä / en muista

Muistatko mitä

Arvioitko että se oli gluteenitonta? Kyllä Ei En tiedä / en muista

Tallenna vastaukset

Kysymyksiä koiranne pentuajasta (2-6 kk):

Jos osaatte vastata osaan kysymyksistä 33-39, niin olemme jo kiitollisia. Jos ette omistaneet koiraa silloin kun se oli 2-6 kk vanha ja jos ette millään saa tietoonne vastauksia pentuiästä ja ette itse tiedä, rastittakaa tähän ja siirtykää sitten kysymykseen 40.

33. Minkälaiset ohjeet saitte kasvattajalta liikunnan suhteen?

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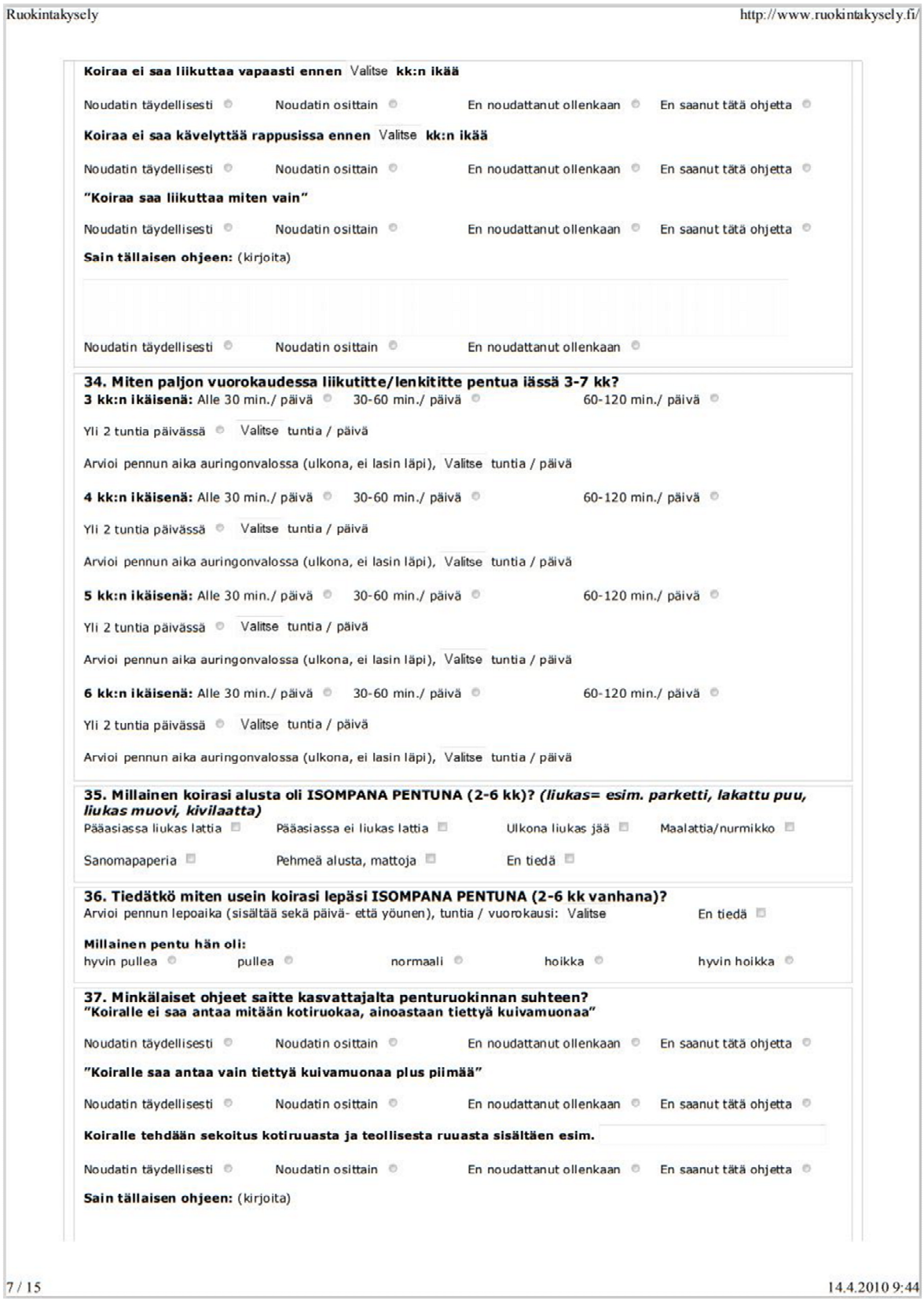

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Koiraa ei saa liikuttaa vapaasti ennen Valitse **kk:n ikää**

Noudatin täydellisesti ○ Noudatin osittain ○ En noudattanut ollenkaan ○ En saanut tätä ohjetta ○

Koiraa ei saa kävelyttää rappusissa ennen Valitse **kk:n ikää**

Noudatin täydellisesti ○ Noudatin osittain ○ En noudattanut ollenkaan ○ En saanut tätä ohjetta ○

"Koiraa saa liikuttaa miten vain"

Noudatin täydellisesti ○ Noudatin osittain ○ En noudattanut ollenkaan ○ En saanut tätä ohjetta ○

Sain tällaisen ohjeen: (kirjoita)

Noudatin täydellisesti ○ Noudatin osittain ○ En noudattanut ollenkaan ○

34. Miten paljon vuorokaudessa liikutitte/lenkititte pentua iässä 3-7 kk?

3 kk:n ikäisenä: Alle 30 min./ päivä ○ 30-60 min./ päivä ○ 60-120 min./ päivä ○

Yli 2 tuntia päivässä ○ Valitse tuntia / päivä

Arvioi pennun aika auringonvalossa (ulkona, ei lasin läpi), Valitse tuntia / päivä

4 kk:n ikäisenä: Alle 30 min./ päivä ○ 30-60 min./ päivä ○ 60-120 min./ päivä ○

Yli 2 tuntia päivässä ○ Valitse tuntia / päivä

Arvioi pennun aika auringonvalossa (ulkona, ei lasin läpi), Valitse tuntia / päivä

5 kk:n ikäisenä: Alle 30 min./ päivä ○ 30-60 min./ päivä ○ 60-120 min./ päivä ○

Yli 2 tuntia päivässä ○ Valitse tuntia / päivä

Arvioi pennun aika auringonvalossa (ulkona, ei lasin läpi), Valitse tuntia / päivä

6 kk:n ikäisenä: Alle 30 min./ päivä ○ 30-60 min./ päivä ○ 60-120 min./ päivä ○

Yli 2 tuntia päivässä ○ Valitse tuntia / päivä

Arvioi pennun aika auringonvalossa (ulkona, ei lasin läpi), Valitse tuntia / päivä

35. Millainen koirasi alusta oli ISOMPANA PENTUNA (2-6 kk)? *(liukas= esim. parketti, lakattu puu, liukas muovi, kivilaatta)*

Pääasiassa liukas lattia ☐ Pääasiassa ei liukas lattia ☐ Ulkona liukas jää ☐ Maalattia/nurmikko ☐

Sanomapaperia ☐ Pehmeä alusta, mattoja ☐ En tiedä ☐

36. Tiedätkö miten usein koirasi lepäsi ISOMPANA PENTUNA (2-6 kk vanhana)?

Arvioi pennun lepoaika (sisältää sekä päivä- että yöunen), tuntia / vuorokausi: Valitse En tiedä ☐

Millainen pentu hän oli:

hyvin pullea ○ pullea ○ normaali ○ hoikka ○ hyvin hoikka ○

37. Minkälaiset ohjeet saitte kasvattajalta penturuokinnan suhteen?

"Koiralle ei saa antaa mitään kotiruokaa, ainoastaan tiettyä kuivamuonaa"

Noudatin täydellisesti ○ Noudatin osittain ○ En noudattanut ollenkaan ○ En saanut tätä ohjetta ○

"Koiralle saa antaa vain tiettyä kuivamuonaa plus piimää"

Noudatin täydellisesti ○ Noudatin osittain ○ En noudattanut ollenkaan ○ En saanut tätä ohjetta ○

Koiralle tehdään sekoitus kotiruuasta ja teollisesta ruuasta sisältäen esim.

Noudatin täydellisesti ○ Noudatin osittain ○ En noudattanut ollenkaan ○ En saanut tätä ohjetta ○

Sain tällaisen ohjeen: (kirjoita)

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Noudatin täydellisesti ○ Noudatin osittain ○ En noudattanut ollenkaan ○

38. Mitä koiranne söi ISOMPANA PENTUNA (2-6 kk)?
Lisäohjeet: Jos ette esim. syötä jotakin alla olevaa ollenkaan, niin "Valitse"-valikosta ei tarvitse valita mikään, vaan laitatte vain merkin ensimmäisen nappi-rivin 1-kohtaan. Jos taas syötätte esim. kuivamuonaa mutta ette muista mikä se oli nimeltään, tai jos syötätte juustoa mutta ette muista mitä, niin ei tarvitse valita mikään "Valitse"-valikosta mutta täytätte aina kuitenkin nappi-rivin. Kiitos.

Tarkenna, minkä ikäinen koira oli kun se söi kuten alla: noin Valitse - Valitse kuukautta vanha

En muista ollenkaan ○ Koira ei ollut silloin meillä ○

Rastittakaa yksi sopiva vaihtoehto per rivi: 1 = ei koskaan, 2 = muutaman kerran vuodessa, 3 = muutaman kerran kuukaudessa, 4 = muutaman kerran viikossa, 5 = aina / miltei aina / päivittäin)

	1	2	3	4	5		1	2	3	4	5
Kuivamuonaa						Koirille tarkoitettua säilykeruokaa tai koiramakkaraa					
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Sairauksien erikoisruuat						Koirille tarkoitettua tuoreruokaa					
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Kypsennyttyä lihaa						Kypsentämätöntä lihaa					
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Kypsennettyjä sisäelimiä						Kypsentämättömiä sisäelimiä					
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Kypsennettyä kalaa						Kypsentämätöntä kalaa					
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Kypsennettyjä luita tai rustoluita	○	○	○	○	○	Kypsentämättömiä luita tai rustoja	○	○	○	○	○
Kypsennettyä naudan mahaa	○	○	○	○	○	Naudan mahaa raakana	○	○	○	○	○
Kypsennettyä kananmunaa						Kypsentämätöntä kananmunaa					
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Nakki, lenkkimakkara yms.	○	○	○	○	○	Verilätyt	○	○	○	○	○
Maksalaatikko	○	○	○	○	○	Ruoantähteitä tai ihmisille tarkoitettua ruokaa (esim. kaikki tähteet, eineksiä, laatikoita)	○	○	○	○	○
Fermentoitua lihaa						Kuivattuja eläintenosia (esim sian tai lampaankorvia, härän häntiä, kuivattua kanaa)					
Valitse	○	○	○	○	○		○	○	○	○	○
Maitoa	○	○	○	○	○	Jäätelöä	○	○	○	○	○
Maitotuotteet						Juustot					
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Kypsennettyjä vihanneksia						Kypsentämättömiä vihanneksia					
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Fermentoitua viljaa						Fermentoituja kasviksia					
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Kypsentämättömiä hedelmiä						Kypsentämättömiä marjoja					
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Valitse	○	○	○	○	○	Valitse	○	○	○	○	○
Keitettyä riisiä	○	○	○	○	○	Muita viljatuotteita	○	○	○	○	○

Appendix 1 continued

Perunaa						Pastaa, couscousia					
Leipää						Gluteenitonta leipää					
Kuivamuonaa makupaloina						Koirankeksejä					
Kuivattuja sisäelimiä Valitse Valitse						Kuivattua kalaa Valitse Valitse					
Puruluita (nahasta valmistettuja)						Ulkona keppejä					
Ulkona raatoja yms.						Ulkona ruohoa					
Multaa						Savea, kiviä					
Ulkona vettä lätäköistä yms.						Ulkona ulosteita Valitse Valitse Mitä?					
Kasvisöljyä Valitse Valitse						Eläinperäiset öljyt ja rasvat Valitse Valitse					
Öljytuotteet Valitse Valitse						Yrjölän puuroa, merkitse myös käytetyt viljat: durra ☐ hirssi ☐ intiaaniriisi ☐ italianpantaheinä ☐ kaura ☐ ohra ☐ riisi ☐ ruis ☐ speltti ☐ tattari ☐ tefheinä ☐ vehnä ☐					
Muu Mitä?						Muu Mitä?					

Täytitkö varmasti kaikki? Tarkastathan vielä kerran? Kiitos!

Voisitteko arvioida miten iso osuus 2-8 kk ikäisen koiranne ruuasta on kuivamuonaa? Valitse %

Voisitteko arvioida miten iso osuus 2-8 kk ikäisen koiranne ruuasta oli muuta teollista ruokaa? Valitse %

Voisitteko arvioida miten iso osuus 2-8 kk ikäisen koiranne ruuasta oli kotiruokaa? Valitse %

Voisitteko arvioida miten iso osuus 2-8 kk ikäisen koiranne ruuasta oli BARFia? Valitse %

39. Jos et vastannut kysymykseen 38. niin vaikka et muista kaikkea niin muistatko/tiedätkö mitä koirasi pääasiassa söi noin 2-6 kk:n iässä?

Lähinnä kotiruokaa ○ Lähinnä teollista muonaa ○ Sekoitus molemmista ○ En tiedä / en muista ○

Muistatko mitä

Arvioitko että se oli gluteenitonta? Kyllä ○ Ei ○ En tiedä / en muista ○

Tallenna vastaukset

Kysymyksiä koiranne nuoruusajasta (pieni rotu 6-12kk, iso rotu 6-18kk):

Jos osaatte vastata osaan kysymyksistä 40-41, niin olemme jo kiitollisia. Jos ette omistaneet koiraa silloin kun se oli 6-18 kk vanha ja jos ette millään saa tietoonne vastauksia pentuiästä ja ette itse tiedä, rastittakaa tähän ☐ ja siirtykää sitten kysymykseen 42.

40. Mitä koiranne söi noin 6-12 (-18) kk vanhana?

Tarkenna, minkä ikäinen koira oli kun se söi kuten alla: noin Valitse - Valitse vanha

Koira on aina syönyt samalla tavalla kuin kysymyksessä no. 38 ○ En muista ollenkaan ○ Koira ei ollut silloin meillä ○

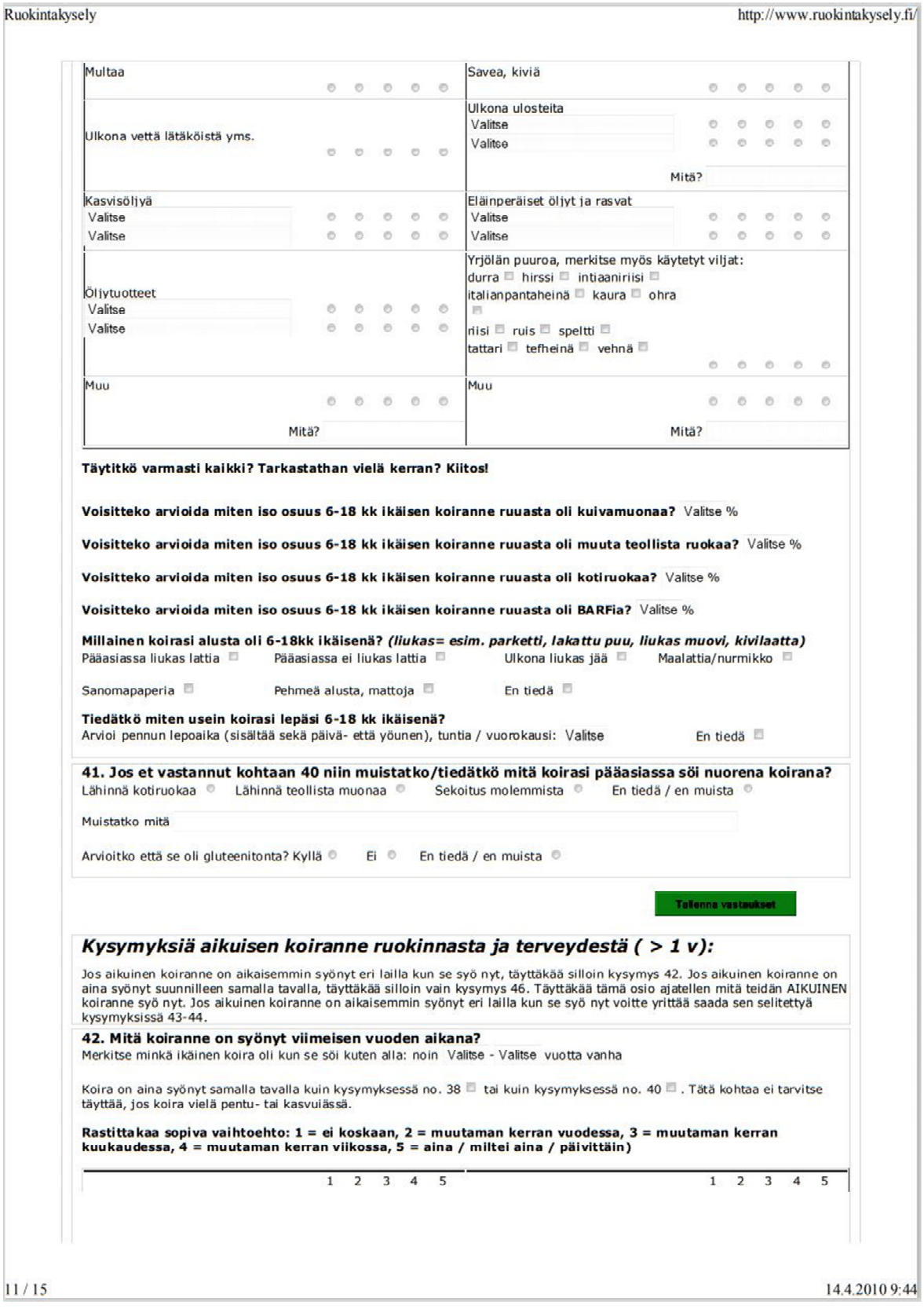
Appendix 1 continued

Rastittakaa sopiva vaihtoehto: 1 = ei koskaan, 2 = muutaman kerran vuodessa, 3 = muutaman kerran kuukaudessa, 4 = muutaman kerran viikossa, 5 = aina / miltei aina / päivittäin)

	1	2	3	4	5
Kuivamuonaa					
Valitse					
Valitse					
Sairauksien erikoisruuat					
Valitse					
Valitse					
Kypsennyttyä lihaa					
Valitse					
Valitse					
Kypsennettyjä sisäelimiä					
Valitse					
Valitse					
Kypsennettyä kalaa					
Valitse					
Valitse					
Kypsennettyjä luita tai rustoluita					
Kypsennettyä naudan mahaa					
Kypsennettyä kananmunaa					
Valitse					
Nakki, lenkkimakkara yms.					
Maksalaatikko					
Fermentoitua lihaa					
Valitse					
Maitoa					
Maitotuotteet					
Valitse					
Valitse					
Kypsennettyjä vihanneksia					
Valitse					
Valitse					
Fermentoitua viljaa					
Valitse					
Kypsentämättömiä hedelmiä					
Valitse					
Valitse					
Keitettyä riisiä					
Perunaa					
Leipää					
Kuivamuonaa makupaloina					
Kuivattuja sisäelimiä					
Valitse					
Valitse					
Puruluita (nahasta valmistettuja)					
Ulkona raatoja yms.					

	1	2	3	4	5
Koirille tarkoitettua säilykeruokaa tai koiramakkaraa					
Valitse					
Valitse					
Koirille tarkoitettua tuoreruokaa					
Valitse					
Valitse					
Kypsentämätöntä lihaa					
Valitse					
Valitse					
Kypsentämättömiä sisäelimiä					
Valitse					
Valitse					
Kypsentämätöntä kalaa					
Valitse					
Valitse					
Kypsentämättömiä luita tai rustoja					
Naudan mahaa raakana					
Kypsentämätöntä kananmunaa					
Valitse					
Verilätyt					
Ruoantähteitä tai ihmisille tarkoitettua ruokaa (esim. kaikki tähteet, eineksiä, laatikoita)					
Kuivattuja eläintenosia (esim sian tai lampaankorvia, härän häntiä, kuivattua kanaa)					
Jäätelöä					
Juustot					
Valitse					
Valitse					
Kypsentämättömiä vihanneksia					
Valitse					
Valitse					
Fermentoituja kasviksia					
Valitse					
Kypsentämättömiä marjoja					
Valitse					
Valitse					
Muita viljatuotteita					
Pastaa, couscousia					
Gluteenitonta leipää					
Koirankeksejä					
Kuivattua kalaa					
Valitse					
Valitse					
Ulkona keppejä					
Ulkona ruohoa					

Appendix 1 continued



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Multaa	Savea, kiviä
Ulkona vettä lätäköistä yms.	Ulkona ulosteita Valitse Valitse Mitä?
Kasvisöljyä Valitse Valitse	Eläinperäiset öljyt ja rasvat Valitse Valitse
Öljytuotteet Valitse Valitse	Yrjölän puuroa, merkitse myös käytetyt viljat: durra hirssi intiaaniriisi italianpantaheinä kaura ohra riisi ruis speltti tattari tefheinä vehnä
Muu Mitä?	Muu Mitä?

Täytitkö varmasti kaikki? Tarkastathan vielä kerran? Kiitos!

Voisitteko arvioida miten iso osuus 6-18 kk ikäisen koiranne ruuasta oli kuivamuonaa? Valitse %

Voisitteko arvioida miten iso osuus 6-18 kk ikäisen koiranne ruuasta oli muuta teollista ruokaa? Valitse %

Voisitteko arvioida miten iso osuus 6-18 kk ikäisen koiranne ruuasta oli kotiruokaa? Valitse %

Voisitteko arvioida miten iso osuus 6-18 kk ikäisen koiranne ruuasta oli BARFia? Valitse %

Millainen koirasi alusta oli 6-18kk ikäisenä? ***(liukas= esim. parketti, lakattu puu, liukas muovi, kivilaatta)***
Pääasiassa liukas lattia Pääasiassa ei liukas lattia Ulkona liukas jää Maalattia/nurmikko
Sanomapaperia Pehmeä alusta, mattoja En tiedä

Tiedätkö miten usein koirasi lepäsi 6-18 kk ikäisenä?
Arvioi pennun lepoaika (sisältää sekä päivä- että yöunen), tuntia / vuorokausi: Valitse En tiedä

41. Jos et vastannut kohtaan 40 niin muistatko/tiedätkö mitä koirasi pääasiassa söi nuorena koirana?
Lähinnä kotiruokaa Lähinnä teollista muonaa Sekoitus molemmista En tiedä / en muista

Muistatko mitä

Arvioitko että se oli gluteenitonta? Kyllä Ei En tiedä / en muista

Tallenna vastaukset

Kysymyksiä aikuisen koiranne ruokinnasta ja terveydestä (> 1 v):

Jos aikuinen koiranne on aikaisemmin syönyt eri lailla kun se syö nyt, täyttäkää silloin kysymys 42. Jos aikuinen koiranne on aina syönyt suunnilleen samalla tavalla, täyttäkää silloin vain kysymys 46. Täyttäkää tämä osio ajatellen mitä teidän AIKUINEN koiranne syö nyt. Jos aikuinen koiranne on aikaisemmin syönyt eri lailla kun se syö nyt voitte yrittää saada sen selitettyä kysymyksissä 43-44.

42. Mitä koiranne on syönyt viimeisen vuoden aikana?
Merkitse minkä ikäinen koira oli kun se söi kuten alla: noin Valitse - Valitse vuotta vanha

Koira on aina syönyt samalla tavalla kuin kysymyksessä no. 38 tai kuin kysymyksessä no. 40 . Tätä kohtaa ei tarvitse täyttää, jos koira vielä pentu- tai kasvuiässä.

Rastittakaa sopiva vaihtoehto: 1 = ei koskaan, 2 = muutaman kerran vuodessa, 3 = muutaman kerran kuukaudessa, 4 = muutaman kerran viikossa, 5 = aina / miltei aina / päivittäin)

1 2 3 4 5	1 2 3 4 5

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Kuivamuonaa Valitse Valitse	Koirille tarkoitettua säilykeruokaa tai koiramakkaraa Valitse Valitse
Sairauksien erikoisruuat Valitse Valitse	Koirille tarkoitettua tuoreruokaa Valitse Valitse
Kypsennyttyä lihaa Valitse Valitse	Kypsentämätöntä lihaa Valitse Valitse
Kypsennettyjä sisäelimiä Valitse Valitse	Kypsentämättömiä sisäelimiä Valitse Valitse
Kypsennettyä kalaa Valitse Valitse	Kypsentämätöntä kalaa Valitse Valitse
Kypsennettyjä luita tai rustoluita	Kypsentämättömiä luita tai rustoja
Kypsennettyä naudan mahaa	Naudan mahaa raakana
Kypsennettyä kananmunaa Valitse	Kypsentämätöntä kananmunaa Valitse
Nakki, lenkkimakkara yms.	Verilätyt
Maksalaatikko	Ruoantähteitä tai ihmisille tarkoitettua ruokaa (esim. kaikki tähteet, eineksiä, laatikoita)
Fermentoitua lihaa Valitse	Kuivattuja eläintenosia (esim sian tai lampaankorvia, härän häntiä, kuivattua kanaa)
Maitoa	Jäätelöä
Maitotuotteet Valitse Valitse	Juustot Valitse Valitse
Kypsennettyjä vihanneksia Valitse Valitse	Kypsentämättömiä vihanneksia Valitse Valitse
Fermentoitua viljaa Valitse	Fermentoituja kasviksia Valitse
Kypsentämättömiä hedelmiä Valitse Valitse	Kypsentämättömiä marjoja Valitse Valitse
Keitettyä riisiä	Muita viljatuotteita
Perunaa	Pastaa, couscousia
Leipää	Gluteenitonta leipää
Kuivamuonaa makupaloina	Koirankeksejä
Kuivattuja sisäelimiä Valitse Valitse	Kuivattua kalaa Valitse Valitse
Puruluita (nahasta valmistettuja)	Ulkona keppejä
Ulkona raatoja yms.	Ulkona ruohoa
Multaa	Savea, kiviä
Ulkona vettä lätäköistä yms.	Ulkona ulosteita Valitse Valitse

Appendix 1 continued

	Mitä?
Kasvisöljyä Valitse Valitse	Eläinperäiset öljyt ja rasvat Valitse Valitse
Öljytuotteet Valitse Valitse	Yrjölän puuroa, merkitse myös käytetyt viljat: durra hirssi intiaaniriisi italianpantaheinä kaura ohra riisi ruis speltti tattari tefheinä vehnä
Muu Mitä?	Muu Mitä?

Täytitkö varmasti kaikki? Tarkastathan vielä kerran? Kiitos!

Voisitteko arvioida miten iso osuus aikuisen koiranne ruuasta on kuivamuonaa? Valitse %

Voisitteko arvioida miten iso osuus aikuisen koiranne ruuasta on muuta teollista ruokaa? Valitse %

Voisitteko arvioida miten iso osuus aikuisen koiranne ruuasta on kotiruokaa? Valitse %

Voisitteko arvioida miten iso osuus aikuisen koiranne ruuasta on BARFia? Valitse %

Millainen aikuisen koirasi alusta on? ***(liukas= esim. parketti, lakattu puu, liukas muovi, kivilaatta)***

Pääasiassa liukas lattia Pääasiassa ei liukas lattia Ulkona liukas jää Maalattia/nurmikko

Sanomapaperia Pehmeä alusta, mattoja En tiedä

Miten usein koirasi lepää?

Miten paljon aikuinen koirasi lepää, tuntia / vuorokausi: Valitse En tiedä

43. Missä iässä olette vaihtaneet koiranne dieettiä?. Alla voitte kertoa kolmesta vaihdosta. Jos ette halua vastata tähän kysymykseen, siirtykää kysymykseen 44 tai 45.

Ensimmäisen kerran kun koira oli noin Valitse **vuotta, silloin vaihdoin:**

- a) Miltei tai täysin teollisesta vaihdoin ½ koti + ½ teolliseen ruokaan
- b) Miltei tai täysin teollisesta kokonaan kotiruokaan
- c) Miltei tai täysin teollisesta ruuasta BARFiin
- d) Kotiruuasta täysin teolliseen
- e) Kotiruuasta täysin BARFiin
- f) Barfista teolliseen
- g) Barfista kotiruokaan
- h) Teollisesta teolliseen ruokaan
- i) ½ koti + ½ teollisesta ruuasta teolliseen ruokaan

Mikä oli syy, että vaihdoitte dieettiä?

Hinta Saatavuus Jonkun suosittelema Sairaus Valitse Lihoi

Vaihtelua koiralle Ilmavaivat Haiseva henki Ruokahaluttomuus

Etsinyt parempaa ruuansulatuksen suhteen Luustovaivoja nuorena Nivelrikkoruokaan

Ruuat vaihdettiin toisen koiran takia Koiralla aina eri ruuat Vaihdan ruokamerkkiä välillä

Muu syy, mikä

Jos syy oli sairaus, auttoiko ruokinnan muutos siihen? Kyllä Ei En tiedä / en muista

Jos syy oli sairaus, mikä vaihto auttoi? Valitse joku vaihtoehdoista (a-i): Valitse

---

Toisen kerran kun koira oli noin Valitse **vuotta, silloin vaihdoin:**

- a) Miltei tai täysin teollisesta vaihdoin ½ koti + ½ teolliseenruokaan
- b) Miltei tai täysin teollisesta vaihdoin ½ koti + ½ teolliseenruokaan
- c) Miltei tai täysin teollisesta ruuasta BARFiin

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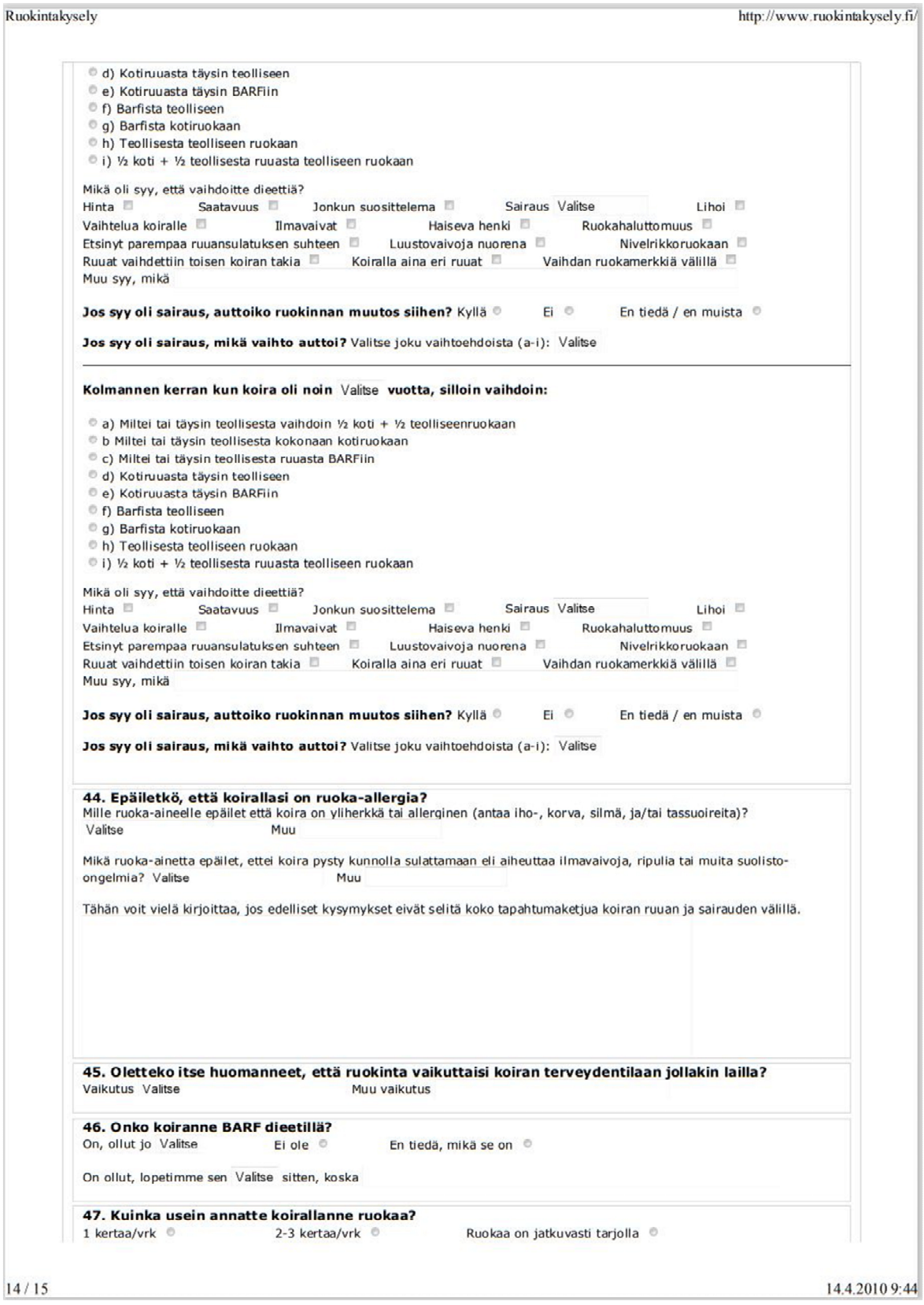

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d) Kotiruuasta täysin teolliseen
e) Kotiruuasta täysin BARFiin
f) Barfista teolliseen
g) Barfista kotiruokaan
h) Teollisesta teolliseen ruokaan
i) ½ koti + ½ teollisesta ruuasta teolliseen ruokaan

Mikä oli syy, että vaihdoitte dieettiä?
Hinta Saatavuus Jonkun suosittelema Sairaus Valitse Lihoi
Vaihtelua koiralle Ilmavaivat Haiseva henki Ruokahaluttomuus
Etsinyt parempaa ruuansulatuksen suhteen Luustovaivoja nuorena Nivelrikkoruokaan
Ruuat vaihdettiin toisen koiran takia Koiralla aina eri ruuat Vaihdan ruokamerkkiä välillä
Muu syy, mikä

Jos syy oli sairaus, auttoiko ruokinnan muutos siihen? Kyllä Ei En tiedä / en muista

Jos syy oli sairaus, mikä vaihto auttoi? Valitse joku vaihtoehdoista (a-i): Valitse

---

Kolmannen kerran kun koira oli noin Valitse **vuotta, silloin vaihdoin:**

a) Miltei tai täysin teollisesta vaihdoin ½ koti + ½ teolliseenruokaan
b Miltei tai täysin teollisesta kokonaan kotiruokaan
c) Miltei tai täysin teollisesta ruuasta BARFiin
d) Kotiruuasta täysin teolliseen
e) Kotiruuasta täysin BARFiin
f) Barfista teolliseen
g) Barfista kotiruokaan
h) Teollisesta teolliseen ruokaan
i) ½ koti + ½ teollisesta ruuasta teolliseen ruokaan

Mikä oli syy, että vaihdoitte dieettiä?
Hinta Saatavuus Jonkun suosittelema Sairaus Valitse Lihoi
Vaihtelua koiralle Ilmavaivat Haiseva henki Ruokahaluttomuus
Etsinyt parempaa ruuansulatuksen suhteen Luustovaivoja nuorena Nivelrikkoruokaan
Ruuat vaihdettiin toisen koiran takia Koiralla aina eri ruuat Vaihdan ruokamerkkiä välillä
Muu syy, mikä

Jos syy oli sairaus, auttoiko ruokinnan muutos siihen? Kyllä Ei En tiedä / en muista

Jos syy oli sairaus, mikä vaihto auttoi? Valitse joku vaihtoehdoista (a-i): Valitse

44. Epäiletkö, että koirallasi on ruoka-allergia?
Mille ruoka-aineelle epäilet että koira on yliherkkä tai allerginen (antaa iho-, korva, silmä, ja/tai tassuoireita)?
Valitse Muu

Mikä ruoka-ainetta epäilet, ettei koira pysty kunnolla sulattamaan eli aiheuttaa ilmavaivoja, ripulia tai muita suolisto-ongelmia? Valitse Muu

Tähän voit vielä kirjoittaa, jos edelliset kysymykset eivät selitä koko tapahtumaketjua koiran ruuan ja sairauden välillä.

45. Oletteko itse huomanneet, että ruokinta vaikuttaisi koiran terveydentilaan jollakin lailla?
Vaikutus Valitse Muu vaikutus

46. Onko koiranne BARF dieetillä?
On, ollut jo Valitse Ei ole En tiedä, mikä se on

On ollut, lopetimme sen Valitse sitten, koska

47. Kuinka usein annatte koirallanne ruokaa?
1 kertaa/vrk 2-3 kertaa/vrk Ruokaa on jatkuvasti tarjolla

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Nappulat annan kuivana kostutettuna

48. Mitä lisäravinteita (pillereitä, pulvereita, liuoksia...vitamiineja, kondroitiineja, glukosamiineja, maitohappobakteereita yms.) koiranne syö nyt? Voit halutessasi valita viisi erilaista

Valitse listasta Valitse
Valitse listasta Valitse
Valitse listasta Valitse
Valitse listasta Valitse
Valitse listasta Valitse

Muu, mitä?

49. Teemme yhteistyötä Hannes Lohen geenitutkimusryhmän kanssa. Pystymme käyttämään näitä tietoja tässä yhteistyössä vain, jos annatte meille joko koiran koko virallisen nimen + syntymäpäivän tai rekisterinumeron. Jos ette kuitenkaan halua, tähän kysymykseen ei tarvitse vastata mitään. Tässä meidän tutkimuksessamme antamianne tietoja pystytään käyttämään ilman näitä tietoja.

Omistajan nimi Koiran nimi

Koiran syntymäaika Koiran rekisterinumero

Olen jo antanut Lohen ryhmälle koirastani verinäytteen En ole En tiedä

Voitte kuitenkin pyytää eläinlääkärinne ottamaan koirastanne verta ja lähettämään sen Lohelle kun käytte eläinlääkärissä muun toimenpiteen vuoksi.

50. Haluatteko kommentoida lisää?

Saatte tästä lomakekoodin joka on koirakohtainen eli jos täytätte tämän lomakkeen monelle eri koirallenne saatte jokaiselle oman koodin. Tälle koiralle koodi on "12712274355092". Koodin avulla voimme kohdentaa myöhemmin mahdollisesti esitettävät kysymykset juuri teidän koirallenne. Syksyllä ilmoitamme teille kun seuraava kyselymme on valmis, se tulee olemaan seurantakysely jolloin viikon aikana mittaatte kaiken mitä annatte koirallenne. Kivaa!!!

KIITOS VASTAUKSISTANNE!

Lisätietoja tutkimuksesta antaa ELT Anna Hielm-Björkman, (anna.hielmbjorkman@gmail.com). Tutkimus julkaistaan kansainvälisissä julkaisuissa sekä Koiramme lehdessä. Omat tiedot eivät ole pakollisia, mutta saatamme ottaa teihin yhteyttä, jos meillä on teidän tietonne. Saatamme myös pyytää teitä osallistumaan johonkin tutkimukseen.

Nimi:

Osoite:

Postinumero:

Postitoimipaikka:

Puhelin:

Ja viimeiseksi, saako teihin ottaa yhteyttä mahdollisen tutkimuksen tiimoilta?
Kyllä Ei

Jos olette vastanneet kaikkiin haluamiinne kysymyksiin ettekä aio enää täydentää vastaustanne myöhemmin, painakaa "Lähetä valmis kysely" - nappia.

Lähetä valmis kysely

Jos aiotte vielä täydentää vastaustanne myöhemmin, painakaa "Tallenna vastaukset" - nappia.

Tallenna vastaukset

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Appendix 2. Non-exclusive licence for depositing the final thesis and opening it for the public and the supervisor's confirmation for allowing the thesis for the defence

Hereby I, **Janette Monica Peltonen (16/06/83)**

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Author of the final thesis Janette Pelt
signature

In Tartu, **17.05.2021**

The core supervisor's approval for the final thesis to be allowed for defence

This is to confirm that the final thesis is allowed for defence.

Anna Hielm-Björkman..... 16.5.2021.....
Supervisor's name and signature Date

Toomas Orro..... .....
Supervisor's name and signature Date